Anritsu

MX860802A/MX860902A
GSM Measurement Software
(For MS8608A/MS8609A)
Operation M...

MP MASTER
MA34524

Read this manual before using the equipment.
Keep this manual with the equipment.

MX860802A/MX860902A
GSM Measurement Software
(For MS8608A/MS8609A)
Operation Manual

First Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Wireless. com Division
Measurement Solutions
ANRITSU CORPORATION

MAR.
2002

Document No.: M-W1795AE-1.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.
Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols used in manual

DANGER ⚠ This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING ⚠ This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION ⚠ This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

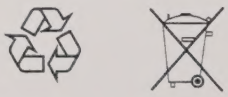
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MX860802A/MX860902A
GSM Measurement Software (For MS8608A/MS8609A)
Operation Manual

27 September 2000 (First Edition)

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For Safety

WARNING ⚠

1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

For Safety

WARNING ⚠

Battery fluid

5. DO NOT short the battery terminals and never attempt to disassemble it or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak.
   This fluid is poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

LCD

6. This instrument uses a Liquid Crystal Display (LCD); DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.
   This liquid is very caustic and poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

For Safety

CAUTION ⚠

Changing Fuse

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. ALWAYS use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

   T5A indicates a time-lag fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Input Level

3. Maximum DC voltage ratings:

   High Power Input and Low Power Input connectors: ±DC 0 V

   Maximum AC power (continuous wave) ratings:

   For MS8608A

   High Power Input connector: +40 dBm

   Low Power Input connector: +20 dBm

   For MS8609A

   +20 dBm

   NEVER input a over maximum ratings to RF Input, excessive power may damage the internal circuits.

For Safety

CAUTION ⚠

Replacing Memory Back-up Battery

4. The power for memory backup is supplied by a Polycarbonmonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type; since replacement can only be made by Anritsu, contact the nearest Anritsu representative when replacement is required.

   Note: *The Battery life is about 7 years. Early battery replacement is recommended.*

Storage Medium

5. This equipment stores data and programs using Plug-in memory card. Data and programs may be lost due to improper use or failure. ANRITSU therefore recommends that you backup the memory.

   Anritsu Corporation will not accept liability for lost data.

   Please pay careful attention to the following points.

   - Do not remove the memory card from equipment being accessed.
   - Isolate the card from static electricity.

Equipment Certificate

Anritsu guarantees that this equipment was inspected at shipment and meets the published specifications.

Anritsu Warranty

- During the warranty period, Anritsu will repair or exchange this software free-of-charge at the company's own discretion if it proves defective when used as described in the operation manual.
- The warranty period is 1 year from the purchase date.
- The warranty period after repair or exchange will remain 1 year from the original purchase date, or 30 days from the date of repair or exchange, depending on whichever is longer.
- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Corporation or its representatives at the address in this manual.

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Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

Trade Mark

Windows is a registered trademark of Microsoft Corporation US.

Front Panel Power Switch

To prevent malfunction caused by accidental touching, the front power switch of this equipment turns on the power if it is pressed continuously for about one second in the standby state. If the switch is pressed continuously for one second in the power-on state, the equipment enters the standby state.

In the power-on state, if the power plug is removed from the outlet, then reinserted into it, the power will not be turned on. Also, if the lines is disconnected due to momentary power supply interruption or power failure, the power will not be turned on (enters the standby state) even if the line is recovered.

This is because this equipment enters the standby state and prevents incorrect data from being acquired when the line has to be disconnected and reconnected.

For example, if the sweep time is 1,000 seconds and data acquisition requires a long time, momentary power supply interruption (power failure) might occur during measurement and the line could be recovered automatically to power-on. In such a case, the equipment may mistake incorrect data for correct data without recognizing the momentary power supply interruption.

If this equipment enters the standby state due to momentary power supply interruption or power failure, check the state of the measuring system and press the front power switch to restore power to this equipment.

Further, if this equipment is built into a system and the system power has to be disconnected then reconnected, the power for this equipment must also be restored by pressing the front power switch.

Consequently, if this equipment is built into remote monitoring systems that use MODEMs, please install option 46 "Auto Power Recovery" to equipment.

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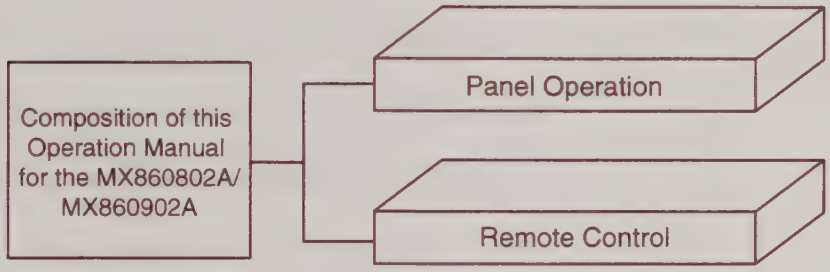
About This Manual

1. The contents of this Operation Manual explain the operation of the MS8608A/ MS8609A Digital Mobile Radio Transmitter Tester when the MX860802A/ MX860902A GSM Measurement Software is installed.

2. Composition of This Operation Manual
   This Operation Manual for the MX860802A/MX860902A GSM Measurement Software is composed of the following two volumes.



Panel Operation:

Contains the overview, panel description, operation and performance test for the MX860802A/MX860902A.

Remote Control:

Describes the RS-232C remote control and GPIB remote control for the MX860802A/MX860902A.

II .

MX860802A/MX860902A
GSM Measurement Software
(For MS8608A/MS8609A)
Operation Manual
(Panel Operation)

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Section 1 General

This Section describes the overview and product configuration of the MX860802A/ MX860902A GSM Measurement Software.

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Overview

The MS8608A/MS8609A Digital Mobile Radio Transmitter Tester (hereinafter referred to as "Transmitter Tester") is an instrument to quickly, accurately and easily measure the transmitter characteristics of base/mobile stations for various types of mobile communications.
In addition to the RF/IF signal evaluation function, it has an IQ (base band) signal analysis function for evaluation of devices.
This Transmitter Tester incorporates a high performance spectrum analyzer and a power meter as standard compositions.
Installation of measurement software provides a modulation analysis function for various types of digital modulation systems.
High-speed digital signal processing technology allows quick and highly accurate measurement.

By installing the MX860802A/MX860902A GSM Measurement Software (hereinafter referred to as "GSM software"), this Transmitter Tester can be a comprehensive measuring instrument to easily measure the functions and performance of the radio equipment for the GSM (including EDGE*1) system digital cellular portable telephone.

A Transmitter Tester installed with the GSM software has the following measuring functions:

- Modulation accuracy analysis, Carrier frequency measurement
- Transmission power measurement, Power measurement at carrier Off, On/Off ratio measurement
- Power vs. time template judgement
- Output RF spectrum measurement
- Spurious measurement, etc.

*1: The EDGE system is an expanded system for GSM system whose modulation system is changed from GMSK to 8PSK.

Configuration

The combination between GSM Software and Transmitter Tester, and each the product configuration are as follows:

- For MS8608A Transmitter Tester

	Name	Qty.	Model name, ordering no.	Remarks
Software	GSM measurement software	1	MX860802A	Supplied by ATA card
Accessory	Operation manual	1	W1795AE	

- For MS8609A Transmitter Tester

	Name	Qty.	Model name, ordering no.	Remarks
Software	GSM measurement software	1	MX860902A	Supplied by ATA card
Accessory	Operation manual	1	W1795AE	

Specifications

MX860802A GSM Measurement Software Specifications for MS8608A

Item	Specifications	Remarks
Model name, Item name	MX860802A GSM Measuring software (for MS8608A)	
Use	Measurement of transmission characteristics for the GSM system mobile radio equipment	
Electric performance (for RF input)	The following specifications are guaranteed after the level optimization of the MS8608A is performed (automatically performed by pressing a key). *1: Pre-amplifier On can be set when the MS8608A-08 (Option 08) is installed.	
Modulation/Frequency measurement		
Measured frequency range	50 MHz to 2.7 GHz	
Measurement level range	–20 to +40 dBm (Average power during burst-on): High Power input –40 to +20 dBm (Average power during burst-on): Low Power input –60 to +10 dBm (Average power during burst-on): Low Power input, When Pre-amplifier is ON *1	
Carrier frequency accuracy	Input level (Average power during burst-on): ≥–10dBm (High Power input), ≥–30 dBm (Low Power input), ≥–40 dBm (Low Power input, Low Power input, When Pre-amplifier is ON *1) ± (Reference crystal oscillator accuracy +10 Hz)	
Modulation accuracy	Input level (Average power during burst-on): ≥–10 dBm (High Power input), ≥–30 dBm (Low Power input), ≥–40 dBm (Low Power input, Low Power input, When Pre-amplifier is ON *1)	
Residual phase error (GMSK modulation)	<0.5 degree (rms) <2.0 degree (peak)	
Residual EVM (8PSK modulation)	<1.0 % (rms)	
Waveform display	Trellis display (for GMSK modulation) Eye pattern display EVM vs. symbol number display (for 8PSK modulation) Phase error vs. symbol number display Amplitude error vs. symbol number display IQ diagram display	

Item	Specifications	Remarks
Amplitude measurement		
Frequency range	50 MHz to 2.7 GHz	
Measurement level range	–20 to +40 dBm (Average power during burst-on): High Power input –40 to +20 dBm (Average power during burst-on): Low Power input –60 to +10 dBm (Average power during burst-on): Low Power input, When Pre-amplifier is ON *1	
Transmission power measurement	After level calibration using the built-in power meter (automatically calibrated by pressing a key).	
Measurement range	+10 to +40 dBm (Average power during burst-on): High Power input –10 to +20 dBm (Average power during burst-on): Low Power input –10 to +10 dBm (Average power during burst-on): Low Power input, When Pre-amplifier is ON *1	
Accuracy	±0.4 dB	
Power measurement linearity	Input level (Average power during burst-on):≥+10 dBm (High Power input), ≥–10 dBm (Low Power input) , ≥–20 dBm (Low Power input, When Pre-amplifier is ON *1), Without changing the reference level setting after range optimization ±0.2 dB (0 to –30 dB)	
Power measurement at carrier Off	Input level (Average power during burst-on): ≥+10 dBm (High Power input), ≥–10 dBm (Low Power input), ≥–20 dBm (Low Power input and Pre-amplifier On *1)	
Measurement range in Normal mode	≥60 dB (Compared with average power during burst-on)	
Measurement range in Wide dynamic range mode	Average power during burst-on: 1 W (High Power input), Compared with 10 mW (Low Power input) ≥80 dB Measurement lower limit depends on the average noise level: (50 dBm (High Power input, 50 MHz to 2.7 GHz)	
Rise/fall characteristics	Displays waveform synchronized with measured signal data Can display specification line (measured at 1 MHz bandwidth), Pass/Fail judgment available	
Output RF Spectrum measurement		
Frequency range	100 MHz to 2.7 GHz	
Input level range	+10 to +40 dBm (Average power during burst-on): High Power input –10 to +20 dBm (Average power during burst-on): Low Power input –20 to +10 dBm (Average power during burst-on): Low Power input, When Pre-amplifier is ON *1	
Modulated-part measurement range (Spectrum due to modulation)	At CW signal input: ≥60 dB (≥200 kH Detuning) ≥68 dB (≥250 kH Detuning) (For <1.8 MHz detuning, RBW: 30 kHz. For (1.8 MHz detuning, RBW: 100 kHz.)	
Transient-part measurement range (Switching transients)	At CW signal input: ≥63 dB (≥400 kH Detuning)	

Item	Specifications	Remarks
Spurious measurement		
Measurement frequency range	100 kHz to 7.8 GHz. Excluding range within carrier frequency ±50 MHz	
Input level range (Transmission power)	+20 to +40 dBm (Average power during burst-on): High Power input 0 to +20 dBm (Average power during burst-on): Low Power input	
Measuring method		
Sweep method	After sweeping the specified frequency range with spectrum analyzer, detects and displays the peak value. For power ratio, calculates and displays the ratio to Tx Power value. Detection mode is 'Average'.	
Spot method	After sweeping the specified frequency range in time domain mode with spectrum analyzer, displays the average value. For power ratio, calculates and displays the ratio to Tx Power value. Detection mode is 'Average'.	
Search method	After sweeping the specified frequency range with spectrum analyzer; detects the peak value and measures the frequency in time domain mode, and displays the average value. For power ratio, calculates the ratio to Tx Power value and displays it. Detection mode is 'Average'.	
Measurement range	When carrier frequency is between 800 MHz and 1 GHz, and 1.8 GHz and 2 GHz, ≥72 dB (RBW:10 kHz) (100 kHz to 50 MHz, band0) ≥72 dB (RBW:100 kHz) (50 to 500 MHz, band0) In Normal mode ≥66–f[GHz]dB (RBW: 3 MHz) (500 to 3150 MHz, band0 Excluding harmonic frequencies) ≥66 dB (RBW: 3 MHz) (3150 to 7800 MHz, band1)	
Option of MS8608A/MS8609A	In Spurious mode	
When MS8608A-03 is installed	≥66 dB (RBW:3 MHz) (1600 to 7800 MHz, band1)	
Electric performance (IQ input)		
Input method	Balance or Unbalance can be selected.	
Input impedance	1 MΩ (with parallel capacity <100 pF) or 50 Ω can be selected.	
Input level range		
Balance input	Differential voltage range: 0.1 to 1 Vpp (At input connector) Common-phase voltage range: ±2.5 V (At input connector)	
Unbalance input	0.1 to 1 Vpp (At input connector) DC/AC coupling can be switched.	
Measurement item	Modulation accuracy measurement, Amplitude measurement, IQ level measurement	
Modulation accuracy measurement	Input level: ≥0.1V (rms), Temperature range: 18 to 28 °C	
Residual phase error	<0.5 degree (rms), DC coupling	
Residual EVM	<1.0 % (rms), DC coupling	
IQ level measurement		
Level measurement	Measures and displays I and Q input voltages (rms value and peak-to-peak value).	
IQ phase difference measurement	When a CW signal is input to I and Q input connectors, measures and displays the phase difference between I-phase signal and Q-phase signal.	

MX860902A GSM Measurement Software Specifications for MS8609A

Item	Specifications	Remarks
Model name, Item name	MX860902A GSM Measuring software (for MS8609A)	
Use	Measurement of transmission characteristics for the GSM system mobile radio equipment	
Electric performance (for RF input)	The following specifications are guaranteed after the level optimization of the MS8609A is performed. (automatically performed by pressing a key). *1: Pre-amplifier On can be set when the MS8609A-08 (Option 08) is installed.	
Modulation/Frequency measurement		
Measured frequency range	50 MHz to 2.7 GHz	
Measurement level range	–40 to +20 dBm (Average power during burst-on): When Pre-amplifier is Off. –60 to +10 dBm (Average power during burst-on): When Pre-amplifier is On. *1	
Carrier frequency accuracy	Input level (Average power during burst-on): ≥–30 dBm (When Pre-amplifier is Off.), ≥–40 dBm (When Pre-amplifier is On. *1) ± (Reference crystal oscillator accuracy +10 Hz)	
Modulation accuracy	Input level (Average power during burst-on): ≥–30 dBm (When Pre-amplifier is Off.), ≥–40 dBm (When Pre-amplifier is On. *1)	
Residual phase error (GMSK modulation)	<0.5 degree (rms) <2.0 degree (peak)	
Residual EVM (8PSK modulation)	<1.0 % (rms)	
Waveform display	Trellis display (for GMSK modulation) Eye pattern display EVM vs. symbol number display (for 8PSK modulation) Phase error vs. symbol number display Amplitude error vs. symbol number display IQ diagram display	
Amplitude measurement		
Frequency range	50 MHz to 2.7 GHz	
Measurement level range	–40 to +20 dBm (Average power during burst-on): When Pre-amplifier is Off. –60 to +10 dBm (Average power during burst-on): When Pre-amplifier is On. *1	
Transmission power measurement	After level calibration using the built-in power meter (automatically calibrated by pressing a key).	
Measurement range	–10 to +20 dBm (Average power during burst-on): When Pre-amplifier is Off. –10 to +10 dBm (Average power during burst-on): When Pre-amplifier is On. *1	
Accuracy	±0.4 dB	
Power measurement linearity	Input level (Average power during burst-on): ≥–10 dBm (When Pre-amplifier is Off.), ≥–20 dBm (When Pre-amplifier is On. *1), Without changing the reference level setting after range optimization ±0.2 dB (0 to –30 dB)	

Item	Specifications	Remarks
Power measurement at carrier Off	Input level (Average power during burst-on): ≥–10dBm (When Pre-amplifier is Off.), ≥–20 dBm (When Pre-amplifier is On. *1)	
Measurement range in Normal mode	≥60 dB (Compared with average power during burst-on)	
Measurement range in Wide dynamic range mode	Average power during burst-on: Compared with 10 mW ≥80 dB Measurement limit depends on the average noise level: 70 dBm (50 MHz to 2.7 GHz)	
Rise/fall characteristics	Displays waveform synchronized with measured signal data Can display specification line (measured with 1 MHz bandwidth), Pass/Fail judgment available	
Output RF Spectrum measurement		
Frequency range	100 MHz to 2.7 GHz	
Input level range	–10 to +20 dBm (Average power during burst-on): When Pre-amplifier is OFF. –20 to +10 dBm (Average power during burst-on): When Pre-amplifier is ON. *1	
Modulated-part measurement range (Spectrum due to modulation)	At CW signal input: ≥60 dB (≥200 kH Detuning) ≥68 dB (≥250 kH Detuning) (When <1.8 MHz detuning, RBW: 30 kHz. When ≥1.8 MHz detuning, RBW: 100 kHz)	
Transient-part measurement range (Switching transients)	At CW signal input: ≥63 dB (≥400 kH Detuning)	
Spurious measurement		
Measurement frequency range	100 kHz to 12.75 GHz, Excluding range within carrier frequency ±50 MHz	
Input level range (Transmission power)	0 to +20 dBm (Average power during burst-on): When Pre-amplifier is OFF.	
Measuring method		
Sweep method	After sweeping the specified frequency range with spectrum analyzer, detects and displays the peak value. For power ratio, calculates and displays the ratio to Tx Power value. Detection mode is 'Average'.	
Spot method	After sweeping the specified frequency range in time domain mode with spectrum analyzer, displays the average value. For power ratio, calculates and displays the ratio to Tx Power value. Detection mode is 'Average'.	
Search method	After sweeping the specified frequency range with spectrum analyzer; detects the peak value and measures the frequency in time domain mode, and displays the average value. For power ratio, calculates the ratio to Tx Power value and displays it. Detection mode is 'Average'.	
Measurement range	When carrier frequency is between 800 MHz and 1 GHz, and 1.8 GHz and 2 GHz, ≥72 dB (RBW:10 kHz) (100 kHz to 50 MHz, band0) ≥72 dB (RBW:100 kHz) (50 to 500 MHz, band0) ≥66–f[GHz]dB (RBW: 3 MHz) (500 to 3150 MHz, band0 Excluding harmonic frequencies) ≥66 dB (RBW: 3 MHz) (3150 to 7800 MHz, band1)	

Item	Specifications	Remarks
Electric performance (IQ input)		
Input method	Balance or Unbalance can be selected.	
Input impedance	1 MΩ (with parallel capacity <100 pF) or 50 Ω can be selected.	
Input level range		
Balance input	Differential voltage range: 0.1 to 1 Vpp (At input connector)	
	Common-phase voltage range: ±2.5 V (At input connector)	
Unbalance input	0.1 to 1 Vpp (At input connector)	
	DC/AC coupling can be switched.	
Measurement item	Modulation accuracy measurement, Amplitude measurement, IQ level measurement	
Modulation accuracy measurement	Input level: ≥0.1V (rms), Temperature range: 18 to 28 °C	
Residual phase error	<0.5 degree (rms), DC coupling	
Residual EVM	<1.0 % (rms), DC coupling	
IQ level measurement		
Level measurement	Measures and displays I and Q input voltages (rms value and peak-to-peak value).	
IQ phase difference measurement	When a CW signal is input to I and Q input connectors, measures and displays the phase difference between I-phase signal and Q-phase signal.	

Section 2 Panel Layout and Operation Overview

This section explains the panel layout and its basic operation of the MX8608A/MS8609A Digital Mobile Radio Transmitter Tester.

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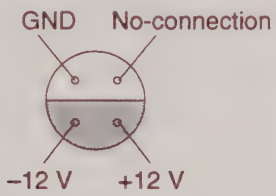
Table of Front and Rear Panel Features

No.	Panel Marking	Explanation of Function
1	(LCD)	This is a 6.5" Type color TFT liquid crystal display (LCD). It displays the trace waveforms, the parameter settings, the values of marker, and the soft menu keys, etc.
2	Spectrum	This sets the MS8608A/MS8609A to the spectrum analyzer mode.
3	Tx Tester	This sets the MS8608A/MS8609A to the transmitter (Tx) tester mode in which the measurement software operates.
4	Config	This displays the setup menu for GPIB interface or printer, etc.
5	F 1 - F 6	These are the soft keys for selecting the soft-key menus linked to the panel key operation. [More] This displays the next page of soft-key menus.
6	Freq/Ampl	This is the frequency and level parameter data input section. [Freq/Channel] Sets frequency. [Span] Sets frequency span. [Amplitude] Sets reference level. [–> CF] Sets peak level signal frequency on screen to center frequency. [–> RLV] Sets peak level on screen to reference level.
7	Marker	This section is related to operation of marker functions. [Marker] Sets marker. [Multi Mkr] Sets multimarkers. Press this key after pressing the [Shift] key. [Peak Search] Moves marker to currently-displayed peak level. [Marker –>] Sets parameter according to marker value. Press this key after pressing the [Shift] key.
8	System	This switches the measurement system in Tx tester mode.
9	Single	This sets the sweep mode. [Single] Executes single sweep. [Continuous] Executes continuous sweeping. Press this key after pressing the [Shift] key. The initial default is continuous sweeping.

No.	Panel Marking	Explanation of Function
10	Recall	This executes recall/save. [Recall] Reads measurement parameters and waveform data from internal memory or memory card. [Save] Saves measurement parameters and waveform data to internal memory or memory card.
11	Measure	This menu is for performing the various application measurements including frequency measurement, noise measurement, adjacent-channel leakage power measurement, etc.
12	Hi Power	This sets the RF input connectors. The MS8609A have not this key. [High Power] Enables the High Power input connector. [Low Power] Enables the Low Power input connector.
13	Display	This section is for selecting the trace waveform. Normally, in the frequency domain, up to two trace waveforms can be displayed. The zero-span (Time Domain) mode is selected simply by pressing the [Time] key. [A, B] Displays trace A or B waveform in frequency domain. [A/B, A/BG] Displays trace A and B waveforms simultaneously, or displays trace A and BG (background frequency spectrum including trace A) simultaneously. [Time] Switches to zero span (Time domain) mode to display time domain waveforms. [A/Time] Displays trace A and the time domain waveform simultaneously.
14	Trig/Gate	This sets the trigger/gate functions. [Trig/Gate] Sets the sweep-start trigger and gate (to control waveform-data write timing) functions.
15	Coupled Function	This sets the RBW, VBW, sweep time and input attenuator.
16	Entry	These keys set the numeric data, units and special functions. [Rotary knob] Used for moving marker and inputting data. [/,] Increments and decrements input data. [Shift] To execute panel functions indicated by blue letters, press this key and then press the blue-lettered key. [BS] Backspace key for correcting input mistakes. [0-9, . , +/–] Numeric-data setting keys. [GHz, MHz, kHz, Hz] Units keys for frequency, level, time, etc. [set] Key for setting parameters. [Cancel] This cancels the entry that be able to set with [set] key.

No.	Panel Marking	Explanation of Function
17	Preset	This sets the measurement parameters to the default values.
18	Local	This changes the remote status to the local status.
19	Disp On/Off	This sets the liquid crystal display On/Off.
20	Copy	This outputs a hard copy of the screen to a printer or memory Card.
21	Stby/On	This is the power switch. It can be used when the back-panel power switch is on. The power-on condition is fetched from the Stby condition when the key is pressed for about 1 seconds. The equipment is returned to the Stby condition from the power-on condition when the key is pressed again for about 1 seconds.
22	RF Input	This is the RF input connector.
23	I/Q Input	This is the I/Q Input connector. (Input I and Q for Unbalance, and I/$\bar{I}$ and Q/$\bar{Q}$ for Balance.)
24	Prove Power	This is the connector that supplies ±12V for a FET prove. Pin allocation is shown below. 
25	Memory Card	This is the slot to set memory cards which save/load the waveform data and measurement parameters etc.
50	(Fan)	This is the cooling fan for ventilating internally-generated heat. Leave a clearance of at least 10 cm around the fan.
51	10 MHz STD	They are the input connector for an external reference crystal oscillator and the output connector of the 10 MHz Reference signal. When an external reference signal is input, the equipment switches automatically from the internal signal to the external signal. If an external signal is input, the heater of the internal OCXO is switched off.
52	IF Out put	This is the IF output connector. This signal is bandwidth controlled by the RBW setting.

No.	Panel Marking	Explanation of Function
53	Wideband IF OUT	This is the wideband IF output connector. This signal is not bandwidth controlled by the RBW setting.
54	Sweep (X)	This is a output connector for sweep signal (X).
55	Video (Y)	This connector output a Y-axis signal that is proportional to the video detection signal output and is logarithmically compressed at log scale.
56	Sweep Status (Z)	This is a output connector for sweep status signal (Z).
57	Trig/Gate In (±10 V)	This is a input connector for external trigger/gate signal.
58	Off/On	This is the AC line power switch.
59	(Inlet)	This is the fused AC power inlet to which the supplied power cord is connected. It contains a time-lag fuse.
60	(Ground Terminal)	Connect this frame ground terminal to ground to prevent risk of an accidental electric shock.
61	Parallel	This is the Parallel connector. Connect it to a printer.
62	VGA Out	This is the VGA signal output connector.
63	GPIB	This connector is for use with a GPIB interface. It is connected to an external system controller.
64	RS-232C	This is the RS-232C connector. Connect it to an external system controller.
65	Ethernet	This is the 10 Base-T connector for Ethernet. Connect this to the external system controller.
66	Name plate	This shows a production number and options.

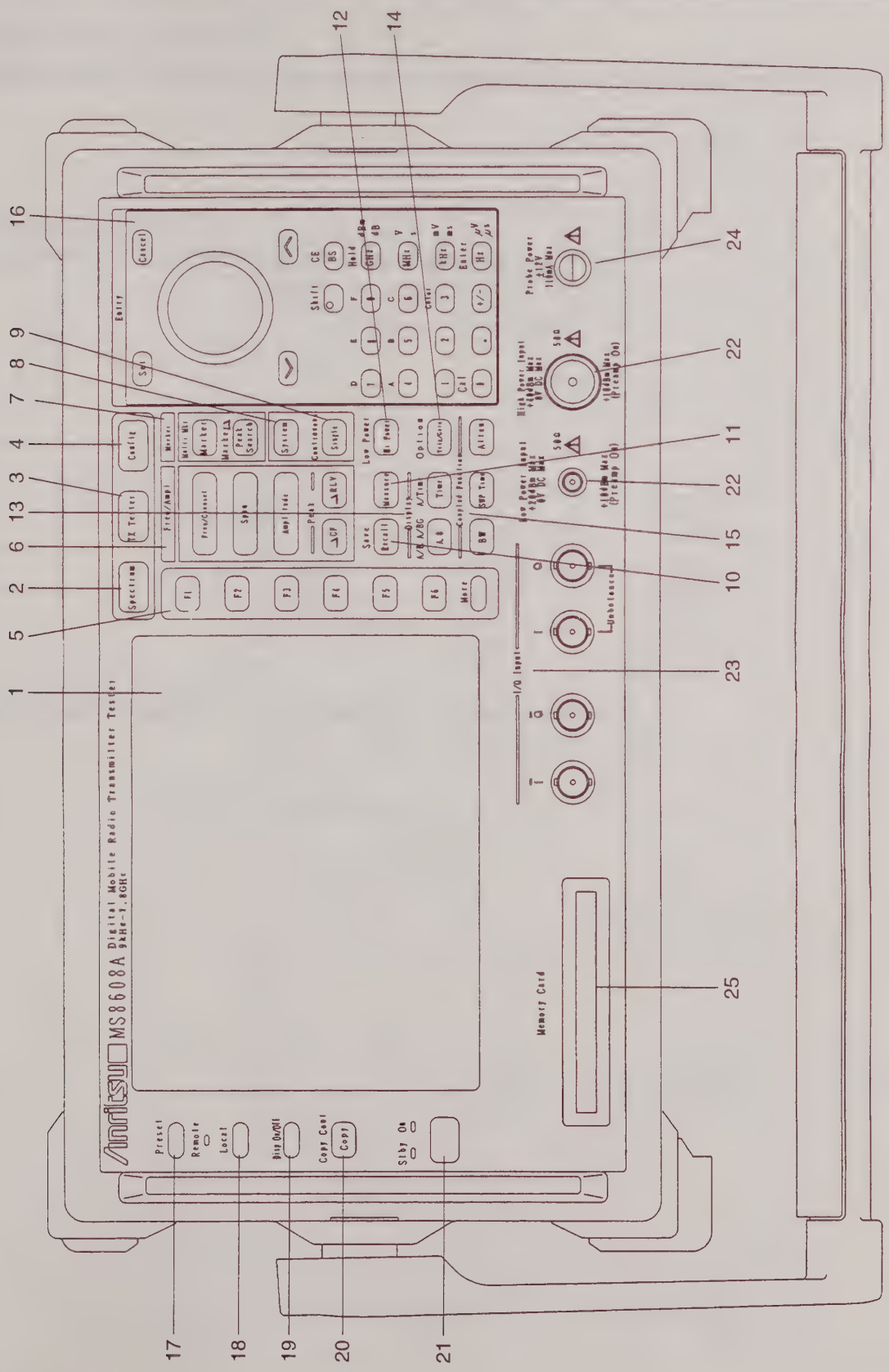


Fig. 2-1 Front Panel of MS8608A

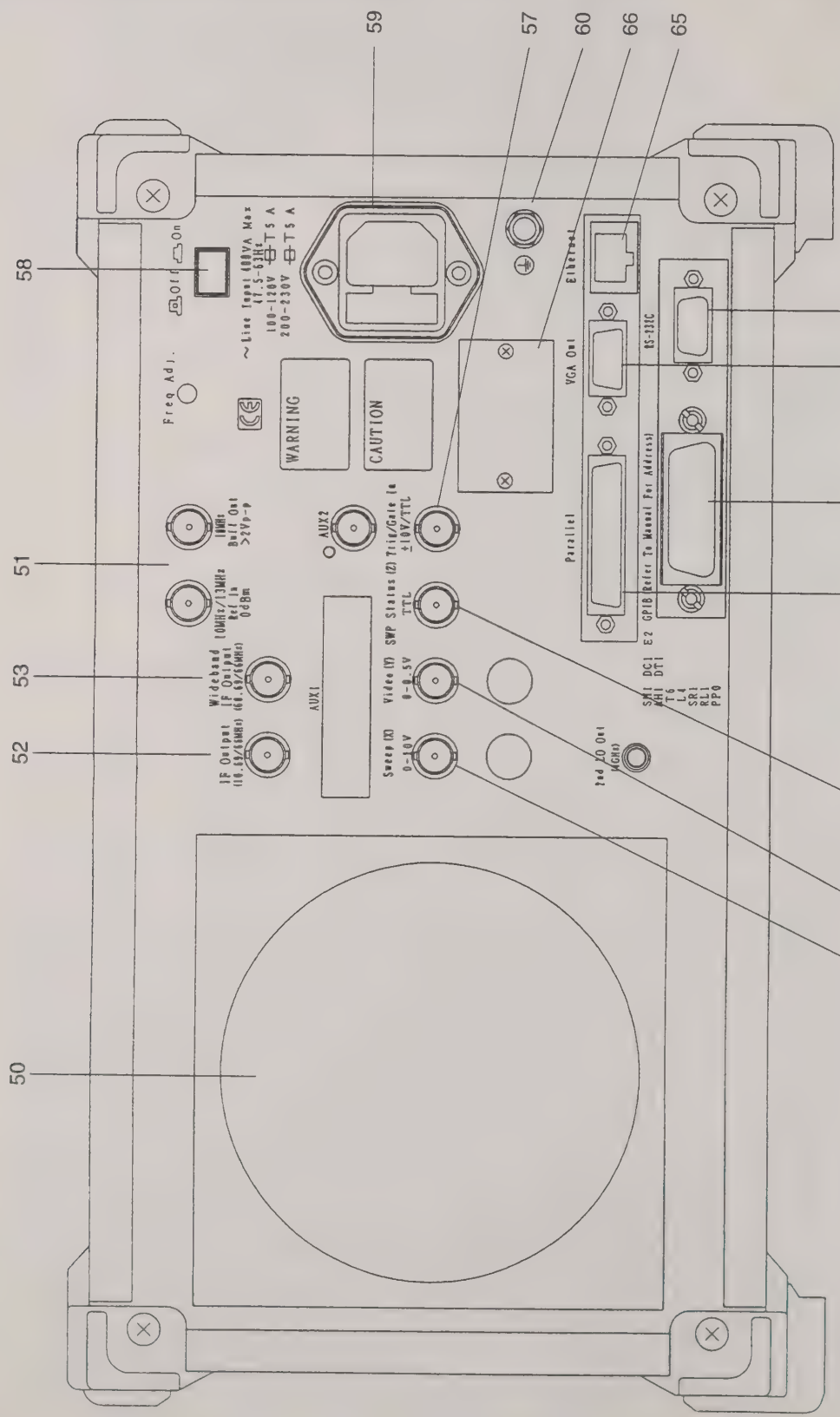


Fig. 2-2 Rear Panel of MS8608A

Basic Operation

This section describes the basic operation and typical parameter setting method.

Turn the power on

Press the standby button on the rear panel, then press the power switch on the front panel. In this case, continue pressing the power switch for one second or more.

> The power is turned on/off only when the power switch is pressed for one second or more. This prevents the power from being turned on/off easily by mistake.

To make full use of this equipment, turn the Line Input power switch to On at least 30 minutes before use (this turns on the Stby (power) lamp on the front panel.) The internal reference frequency oscillator is pre-heated and results in stable operation.

Selecting item

The item with a cursor on the screen indicates that the parameter can be changed, as below.
Some parameters can be set after pressing the corresponding function key, as below.

Setting item with cursor

Move the cursor at the item to be selected using (∧) and (∨) Entry keys and rotary knob.
Then, press (Set) Entry key to confirm the item, and the parameter setting window is open.

Setting item with function key

Press the function key (any of (F1) to (F6) key) to open the parameter setting window.
Some parameters are set only by pressing a function key.

Setting parameter on parameter setting window

Setting parameter on parameter setting window has two types of procedures.

(1) Select one of the parameters shown in the window.

(2) Input a value.

Selecting one of the parameters shown in the window

Move the cursor at the parameter to be selected using (∧) and (∨) Entry keys and rotary knob.

Then, press (Set) Entry key to confirm the parameter.

The window closes.

Inputting value

Input a value using a ten-key pad and rotary knob.

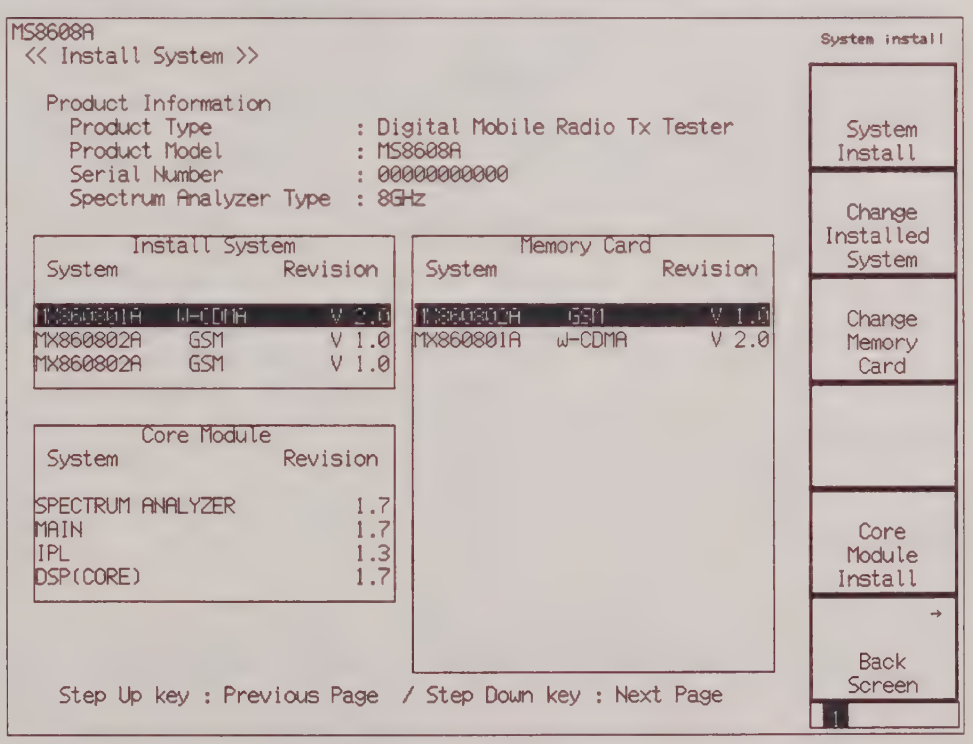
Then, press a unit key or (Set) Entry key to confirm the parameter.

The window closes.

Installing Measurement Software

Install the desired measurement software (sold separately) of the MS8608A/MS8609A in the Transmitter Tester mode, as follows:

Step	Procedure
1	Insert a memory card on which the measurement software is saved into the memory card slot on the panel.
2	Press the (Config) key to display the Config screen.
3	Press (F4) (System Install) to display the Install System screen (shown below).



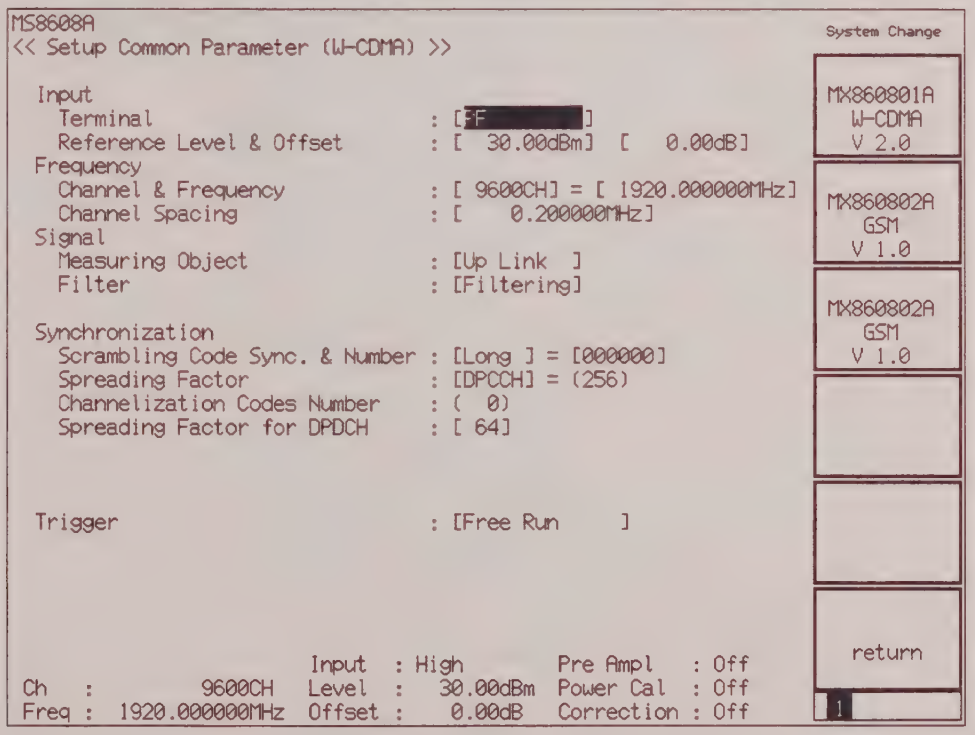
4	Press (F2) (Change Installed System) to make the Install System box active.
5	Select the install destination for the new measurement system using the rotary knob.
6	Press (F3) (Change Memory Card) to make the Memory Card box active.

Step	Procedure
7	Select the new measurement system using the rotary knob.
8	Press (F1) (System Install) to install the new system.
9	The confirmation window opens. Move the cursor to "Yes" using the rotary knob.
10	Press the (Set) Entry key to start installation.
11	After installation is completed, the new measurement system screen appears.

Changing Measurement System

To use the MS8608A/MS8609A with multiple measurement software (sold separately) installed, in the Transmitter Tester mode; change the measurement system to the desired system, as follows:

Step	Procedure
1	Press the (Tx Tester) key to display the measurement system screen.
2	Press the (System) key to display the System Change function label (shown below).



3	All the installed measurement systems are displayed at function labels.
4	Press the function key for the measurement system to be set.
5	The measurement system is changed over.
6	After the setting is completed, a new system screen appears.

A measurement system not displayed in the function labels cannot be set. See "Installing Measurement Software" to install a new measurement system.

Setting Screen Colors

The method for setting the screen display colors are explained here.
The screen colors can be selected from four preset color patterns and one user-defined color pattern.

- Pressing the (Shift) + (3) (Color) keys displays the function labels shown below. Select one to be used:
  - (F1) (Color Pattern 1): Sets the Color Pattern 1 (default at shipment)
  - (F2) (Color Pattern 2): Sets the Color Pattern 2
  - (F3) (Color Pattern 3): Sets the Color Pattern 3
  - (F4) (Color Pattern 4): Sets the Color Pattern 4
  - (F5) (Define User Color): Sets the user-defined color pattern

Setting the user-defined color pattern

- Pressing (F5) (Define User Color) changes the display color pattern to the user-defined one and displays the function labels shown below:
  - (F1) (Copy Color Ptn from): Displays the function labels to select from Color Pattern 1 to 4 as the base color for setting the user-defined color pattern.
  - (F2) (Select Item): Selects item for which the display color is to be set.
  - (F3) (Red): Sets the intensity of red for the item selected by Select Item.
  - (F4) (Green): Sets the intensity of green for the item selected by Select Item.
  - (F5) (Blue): Sets the intensity of blue for the item selected by Select Item.

Section 3 Measurement

This Section explains the parameters set on each screen and how to set them.

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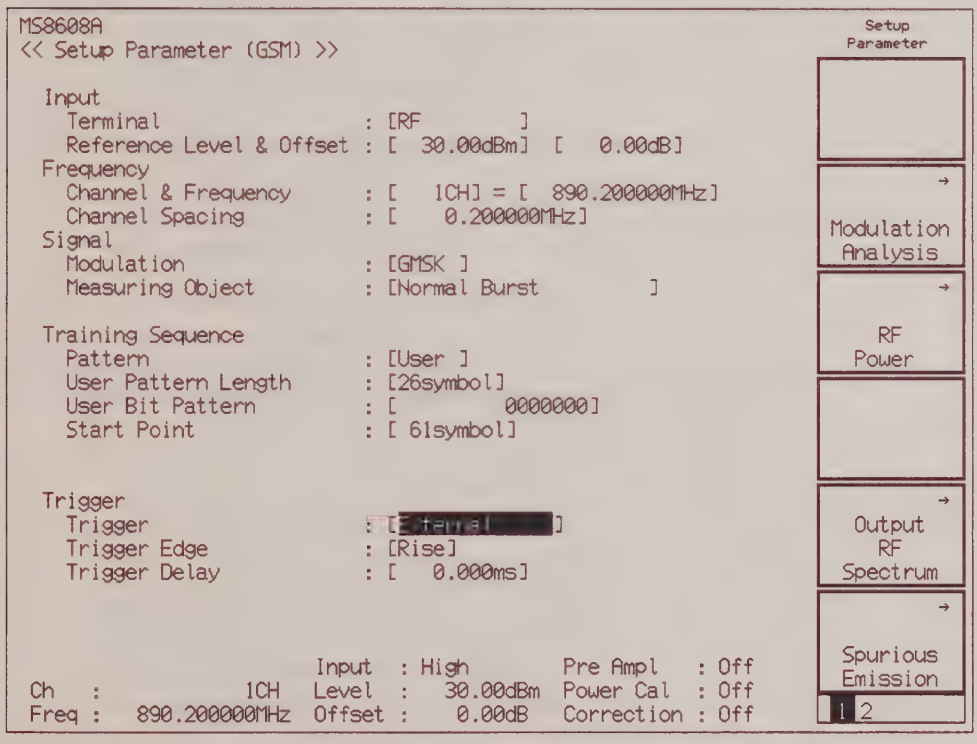
Setting Measurement Parameters

This Section explains the setting of measurement parameters, including input connectors (terminals) and frequencies that are required for measurement.

Set the measurement parameters on the Setup Common Parameter screen.

Press the (Tx Tester) key to display the following Setup Common Parameter screen:



Setting Measured Signal Input Terminal (Terminal)

Select the terminal to input the signal from the DUT (Device Under Test) to be measured, as below.

Step	Procedure
1	Move the cursor to Terminal item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to the desired item with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, the set terminal is displayed in [ ] for Terminal.
Select the terminal from among:

- RF
- IQ-DC
- IQ-AC
- IQ-Balance

If you select IQ, Impedance is displayed at the right, and impedance between 50 Ω and 1 MΩ can be selected.
For the MS8608A, if you select RF, you can switch between High Power input and Low Power input by pressing the (Hi Power) key.

- For High Power input: Press (Hi Power) key.
- For Low Power input: Press (Shift) key, and then (Hi Power) key.

Setting RF Input Level (Reference Level)

Set the input level of the RF signal from the DUT to be measured, as below.

Step	Procedure
1	Move the cursor to Reference Level item with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the level with the numeric key pad.

When setting is completed, the set level is displayed in [ ] for Reference Level.
If you select IQ, this is not displayed.
The Adjust Range function on the measurement screen can set the reference level to the optimum level.

Setting Level Offset Factor (Level Offset)

Set the level offset factor (to be set by user), as below.

Step	Procedure
1	Move the cursor to Offset item with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the level with the numeric key pad.

When setting is completed, the set level is displayed in [ ] for Offset.

Example:

–20 dB for the offset factor of 20 dB amplifier

+10 dB for the offset factor of 10 dB attenuator

Measured RF level display becomes the value calculated by the formula below.

Measured RF level display = Measured value + Offset

Setting Channel and Frequency (Channel & Frequency)

Set the frequency for the signal from the DUT to be measured, as below.

Step	Procedure
1	Move the cursor to Channel or Frequency item with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the channel or frequency with the numeric key pad.

When setting is completed, the set value is displayed in [ ] for the specified item.

If you change the channel, the frequency changes according to the frequency interval.

But even if you change the frequency, the channel remains unchanged.

Set the frequency interval at Channel Spacing item, in the same way as the frequency is set.

Setting Modulation System (Modulation)

Select the modulation system for the signal from the DUT to be measured, as below.

Step	Procedure
1	Move the cursor to Modulation item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to GMSK or 8-PSK with (∧) and (∨) keys or with the rotary knob, according to the modulation system.
5	Press the (Set) key.

When setting is completed, GMSK or 8-PSK is displayed in [ ] for Modulation.
If you set to GMSK, the mode analyses the GSM signal of GMSK modulation.
If you set to 8-PSK, the mode analyses the EDGE signal of 8-PSK modulation.

Setting Burst Format (Measuring Object)

Set the burst format, as below.

Step	Procedure
1	Move the cursor to Measuring Object item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to the desired item with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, the set burst format is displayed in [ ] for Measuring Object.

You can select one of the followings:

- Normal Burst
- Access Burst (only for GMSK)
- Synchronization Burst (only for GMSK)
- Continuous

In Continuous mode, the continuous wave of GMSK or 8-PSK modulation is analyzed.

Setting Training Sequence (Training Sequence)

Select the detection/position-alignment method of the signal of the DUT to be measured among Training Sequence Code, Magnitude change and any pattern specific to the user.

Setting pattern

Step	Procedure
1	Move the cursor to Pattern item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to the desired item with (∧) and (∨) keys or with the rotary knob.
5	Set the value with the numeric key pad or the rotary knob.
6	Press the (Set) key.

When setting is completed, the set pattern is displayed in [ ] for Pattern.
You can select one of the followings:

- TSC0 to 7: Available only for Normal Burst. Performs the measured signal detection/position-alignment with the set pattern.
- ETSC: Available only for Access Burst. Performs the measured signal detection/position-alignment with the set pattern.
- SYNC: Available only for Synchronization Burst. Performs the measured signal detection/position-alignment with the set pattern.
- No: Performs the measured signal detection/position-alignment by changing the magnitude.
- User: Performs the measured signal detection/position-alignment by any pattern defined by the user.

Setting user pattern

(1) Set the pattern data length by user's definition.
- Set the pattern data length by user's definition in User Pattern Length item.
- The unit of the pattern data length is Symbol.
- You can set the pattern length from 1 to 64 symbols for GMSK, and from 1 to 26 symbols for 8-PSK.

(2) Set the pattern data for user's definition.
- Set the pattern data for user's definition in User Bit Pattern.
- Enter a hexadecimal number for GMSK and an octal number for 8-PSK.

(3) Set the pattern start point for user's definition.
- Set the pattern start point for user's definition in Start Point item.

Example: When TSC0 is set with user pattern

- User Pattern Length: 26 symbol
- User Bit Pattern: 0970897
- Start Point: 61 symbol

Setting Trigger (Trigger)

Sets the Trigger.

Setting trigger method

Step	Procedure
1	Move the cursor to Trigger item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to Free Run or External with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, Free Run or External is displayed in [ ] for Screen.

- Free Run: Detects and measures the burst with internal timing.
- External: From the time that the trigger signal from Trig/Gate In on the rear panel is received, the first burst detected is measured.

If you select External, you can set up the edge and delay of the trigger signal.

Setting Trigger Edge

Step	Procedure
1	Move the cursor to Trigger Edge item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to Rise or Fall item with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, Rise or Fall is displayed in [ ] for Trigger Edge.

- Rise: Synchronous with rise edge
- Fall: Synchronous with fall edge

Setting trigger delay

Step	Procedure
1	Move the cursor to Trigger Delay item with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the delay time with the numeric key pad.

When the setting is completed, the set delay time is displayed in [ ] for Trigger Delay

Setting Frequency Characteristics Correction

If you wish to correct the frequency characteristics or loss of the cable connecting a measured item with the transmitter tester, you can save the correction factor for the measuring system in the internal memory of the transmitter tester. The correction factor is then added to the measured value to display the corrected value.
This function allows you to directly read a required measured value by the transmitter tester.

To save the measuring system correction factor in the internal memory of the transmitter tester, see the Operation Manual of the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester, Vol. 2 (on Spectrum Analyzer Function).

The internal memory can save 5 types of correction factor tables.
When using this software, select from among 5 types of correction factor tables saved in the internal memory, as follows:

Selecting correction factor table

Step	Procedure
1	Press the (Magnitude) key to display the Magnitude function label.
2	Press the (F4) (Correction) key to open the window for selection of correction factor table.
3	Move the cursor to the desired correction factor table with (∧) and (∨) keys or with the rotary knob.
4	Press the (Set) key.

When setting is completed, the selected correction factor table is displayed in Correction item in the lower right of the screen.

Setting Pre-amplifier (Pre-amp.)

This function is available only when the MS8608A-08/MS8609A-08 (Option 08) is installed.

Setting pre-amplifier

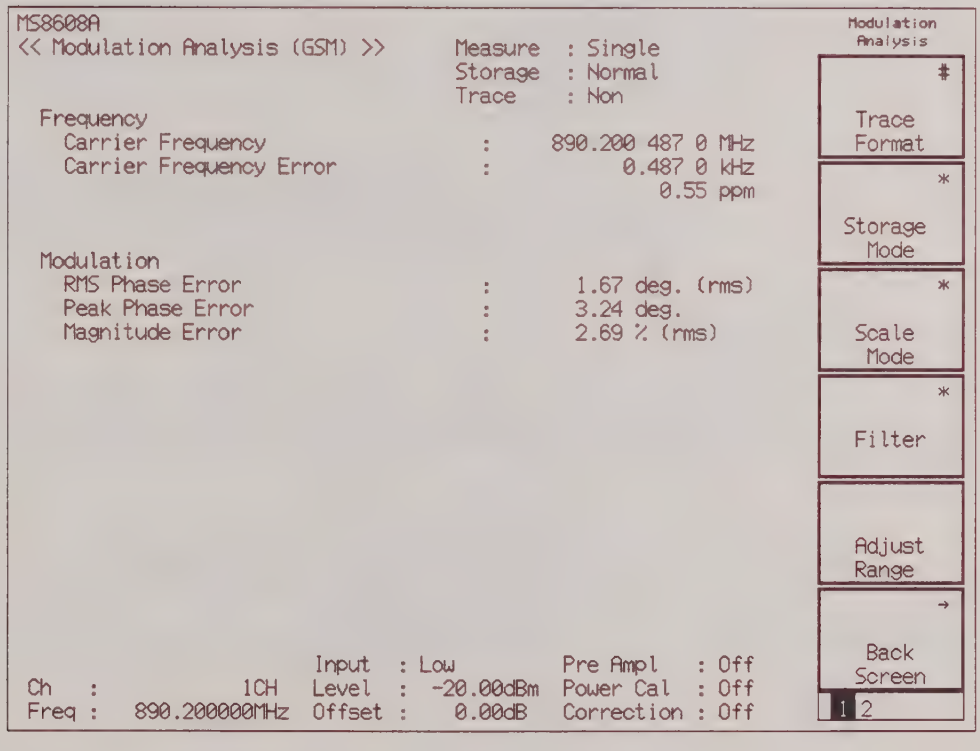
Step	Procedure
1	Press the (Amplitude) key to display the Amplitude function label.
2	Press the (F5) (Pre-amplifier) key to switch On and Off, alternately.

Measuring Modulation Accuracy

This Section explains the measurement results and the parameters set up on the Modulation Analysis screen.

Screen description

When the modulation of Setup Common Parameter is GMSK:



Frequency

(1) Carrier Frequency

Frequency of measured signal obtained by phase locus method displayed in MHz unit.

(2) Carrier Frequency Error

Error in the above carrier frequency against the set frequency in Hz and ppm units.

Modulation

(1) RMS Phase Error

RMS value of phase error for measured signal in degree unit

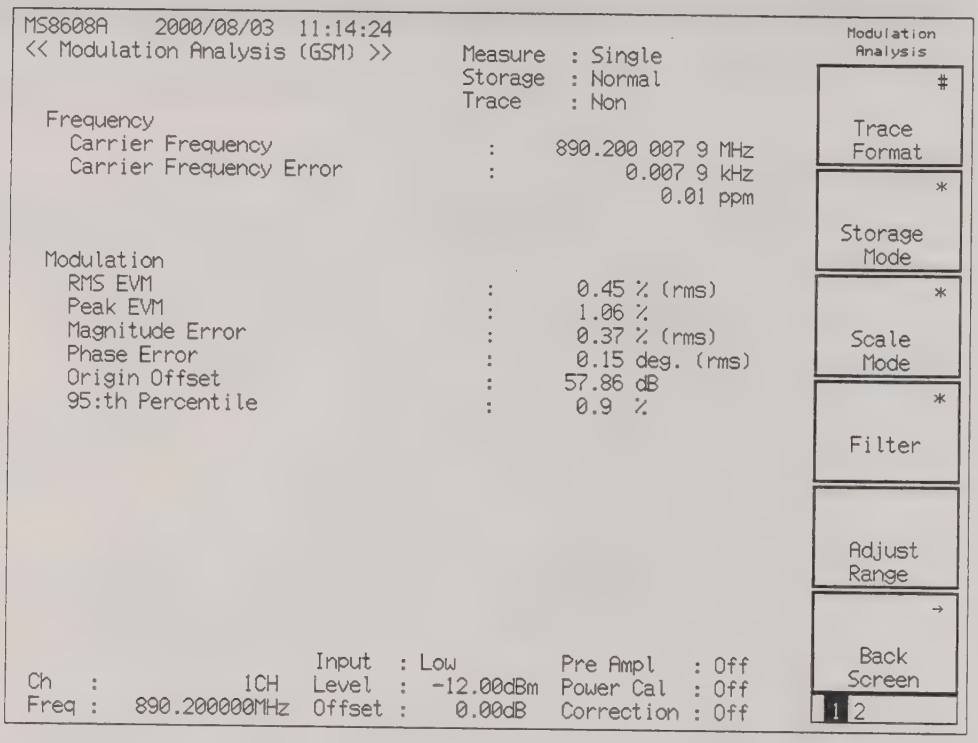
(2) Peak Phase Error

Peak value of phase error for measured signal in degree unit

(3) Magnitude Error

RMS value of magnitude error of measured signal in % unit

When the modulation of Setup Common Parameter is 8-PSK:



Frequency

(1) Carrier Frequency

Frequency of measured signal obtained by phase locus method in MHz unit

(2) Carrier Frequency Error

Error in the above carrier frequency against the set frequency in Hz and ppm units

Modulation

(1) RMS EVM

RMS value of vector error for measured signal in % unit

(2) Peak EVM

Peak value of vector error for measured signal in % unit

(3) Magnitude Error

RMS value of magnitude error for measured signal in % unit

(4) Phase Error

RMS value of phase error for measured signal in degree unit

(5) Orgin Offset

Origin offset (carrier leak conponent) of measured signal in dB unit

(6) 95:th Percentile

EVM value in % unit, obtained when relative probability distribution of EVM of measured signal becomes 95 %.

Setting Waveform Display Format (Trace Format)

Set the waveform display format on the screen by selecting one of the followings:

- Non: Value display only
- Constellation: Constellation display
- Eye Diagram: Eye Diagram display
- EVM: EVM vs. Symbol display (when Modulation of Setup Common Parameter is 8-PSK)
- Phase Error: Phase error vs. Symbol display
- Magnitude Error: Magnitude error vs. Symbol display
- Trellis: Phase vs. Symbol display (when Modulation of Setup Common Parameter is GMSK)

Setting Storage Mode (Storage Mode)

Set the storage mode for measured results, as follows.

Storage mode: Select one of the following storage modes;

- Normal: Measured result is updated and displayed at each measurement end.
- Average: Average of measured result is calculated and displayed at each measurement end.
- Overwrite: Measured value is treated as if in Normal mode, but the waveform display is overwritten.

Average Count: Set the number of average counts.

Refresh Interval: Set the interval for updating the average value, as follows.

- Every: Updated at each measurement end.
- Once: Updated at the measurement end over the number of the averaged counts.

Setting Interpolation Method for Constellation Waveform Display (Interpolation)

Set the interpolation method for constellation waveform display, as follows:

(1) Press the F1 key (Scale Mode) to display the function labels below.
- F1 (Interpolation)
- F4 (Vertical Scale)

(2) Press the [F1] (Interpolation) key to display the function labels below. Select the interpolation method.
- F1 (Non): Displays only symbol point.
- F2 (Linear): Displays symbol points interpolated with linear lines between two symbol points.
- F3 (10 points): Displays symbol points interpolated with ten points between two symbol points.
- F4 (Linear & Symbol Position): Combination (Non and Linear) display
- F5 (10 points & Symbol Position): Combination (Non and 10 points) display
- F6 (return):

Setting Scale of EVM, Phase Error, and Magnitude Error Waveforms (Vertical Scale)

Set the vertical-axis scale for EVM, phase error and magnitude error waveform displays, as follows.

(1) Press the F3 (Scale Mode) key to display the function labels below.
- F1 (Interpolation)
- F4 (Vertical Scale)

(2) Press the F4 (Vertical Scale) key to display the function labels below. Select the vertical-axis scale.

For EVM and magnitude error:
- F1 (5 %): Sets the vertical-axis full scale to 5 %.
- F2 (10 %): Sets the vertical-axis full scale to 10 %.
- F3 (20 %): Sets the vertical-axis full scale to 20 %.
- F4 (50 %): Sets the vertical-axis full scale to 50 %.
- F5 (100 %): Sets the vertical-axis full scale to 100 %.

For phase error:
- F1 (5 deg): Sets the vertical-axis full scale to 5 deg.
- F2 (10 deg): Sets the vertical-axis full scale to 10 deg.
- F3 (20 deg): Sets the vertical-axis full scale to 20 deg.
- F4 (50 deg): Sets the vertical-axis full scale to 50 deg.
- F5 (100 deg): Sets the vertical-axis full scale to 100 deg.

Setting Filter (Filter)

Set up one of the following filters for signal output from the transmitter to be measured (for 8-PSK modulation).

- (F1) (Non): The input signal is analyzed without any filtering processing.
  This filter is used when the signal (which is the GSM 8-PSK modulation signal that passed through the inverse filter to Pulse Shaping Filter, and then made to Nyquist state) is input.
- (F2) (Nyquist): The input signal to the MS8608A/MS8609A passes through the Nyquist filter ($\alpha = 0.25$) before analysis.
  This filter is used when the signal (which is the GSM 8-PSK modulation signal that passed through the inverse filter to Pulse Shaping Filter, at the state of 3/8 π rotation 8-PSK) is input.
- (F3) (Nyquist & Inverse): The input signal to the MS8608A/MS8609A passes through the Nyquist filter ($\alpha = 0.25$) and the inverse filter to the filter (described on GSM 05.04 3.5 Pulse Shaping) before analysis.
  This filter is used to return the signal to the state before the processing of the Pulse Shaping filter (namely, the state of 3/8 π rotation 8-PSK) before analysis.
  In other words, analysis is performed after demodulation.
- (F4) (Spec): The input signal to the MS8608A/MS8609A passes through the measurement filter (described on GSM 05.05 4.6.2 8-PSK modulation) before analysis.
  This filter is selected for the measurement based on the GSM standard.

Setting Marker (Marker)

Display a marker on each waveform when Trace Format is set to other than Non.

Setting marker

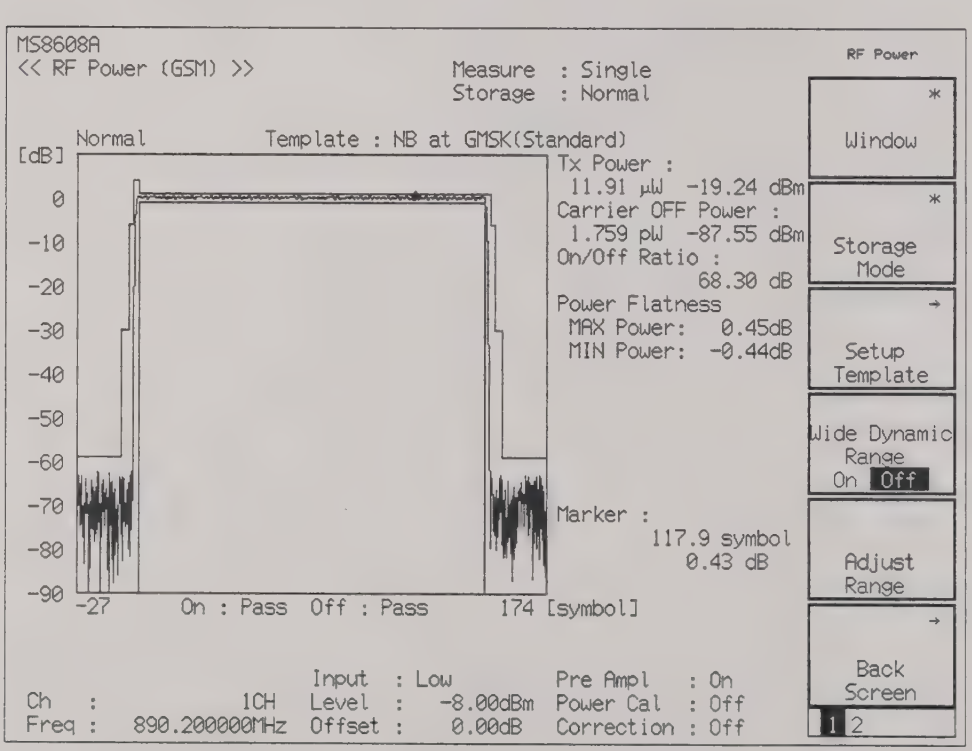
Step	Procedure
1	Press the (Marker) key to display the Marker function labels.
2	Press the (F1) (Marker) key to switch the marker between Normal and Off, alternately.

If set to Normal, a diamond (◆) marker is displayed on the waveform.

Measuring Transmission Power

This Section explains the measurement results and the parameters set up displayed on the RF Power screen.

Screen description



Waveform display

Displays the magnitude measured waveform with Symbol on the horizontal axis and level on the vertical axis.

Displays template (magnitude specification line) when relative level is displayed for magnitude measurement waveform.

Tx Power

Displays average power of measured signal during burst-on.

Carrier OFF Power

Displays average power during transmission Off.

On/Off Ratioo

Displays the power ratio of Tx Power to Carrier Off Power.

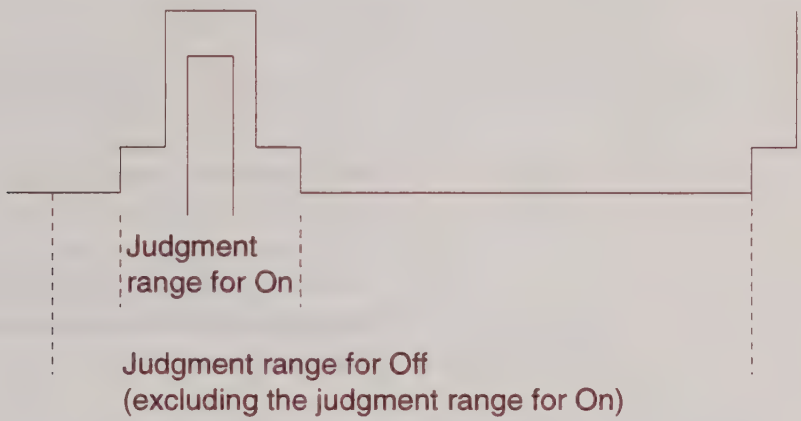
Power Flatness

Displays the maximum and minimum powers in power On interval.

On

Off

Displays Pass/Fail judgment of magnitude measurement waveform by Template.



Setting Waveform Display Range (Window)

Set the display range for the waveform window, as follows:

- Press the F1 (Window) key to display the following function labels. Select the display range for the waveform window.
  - F1 (Slot): Displays the waveform for 1 slot.
  - F2 (On Portion): Displays the enlarged waveform for On portion.
  - F3 (Frame): Displays the waveform for 1 frame.
  - F4 (Leading): Displays the waveform for burst rise-edge portion.
  - F5 (Trailing): Displays the waveform for burst fall-edge portion.

Setting Storage Mode (Storage Mode)

Set the storage mode for measured results, as follows:

Storage Mode: Select one of the following storage modes:

- Normal: Measured result is updated and displayed at each measurement end.
- Average: Measured result is averaged and displayed at each measurement end.

Average Count: Sets the number of averaged counts.

Refresh Interval: Set the updating interval for average value display.

- Every: Updated at each measurement end.
- Once: Updated at the measurement end over the number of averaged counts .

Enlarging Measurement Dynamic Range (Wide Dynamic Range)

Press the F4 (Wide Dynamic Range) key to switch "Wide Dynamic Range" between On and Off. (For GMSK modulation)

When the Wide Dynamic Range is set to On, you can enlarge the measurement dynamic range by measuring with different RF attenuator settings in burst-on and burst-off portions. This measurement is performed in single measurement mode.

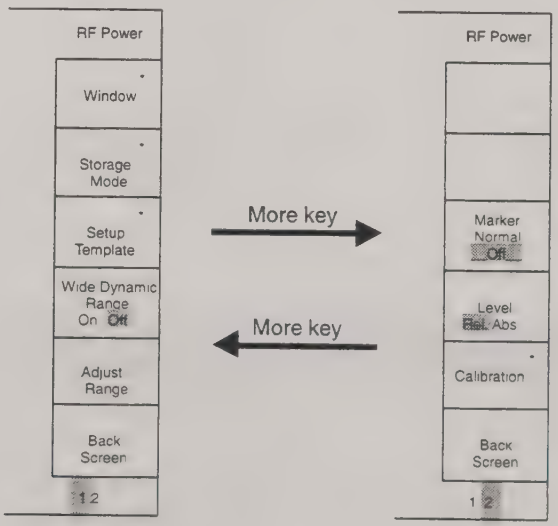
CAUTION ⚠

When the Wide Dynamic Range is set to On, the RF attenuator setting is switched in burst-on and burst-off portions for the measurement. So, the RF attenuator is switched more frequently than in ordinary measurement mode.
The life time of RF attenuator switchings is 5 million times.

Setting Waveform Relative/Absolute Display (Level Rel./Abs.)

Set the Relative display/Absolute display of waveform, as follows:

(1) Press the More key to display the second page of RF Power function label.



(2) Press the F4 (Level Rel./Abs.) key to set the level display mode between Relative and Absolute, alternately.

Setting Marker (Marker)

On RF Power screen, you can display a marker on the waveform.

Setting marker

Step	Procedure
1	Press the (Marker) key to display the Marker function labels.
2	Press the (F1) (Marker) key to switch the marker between Normal and Off, alternately.

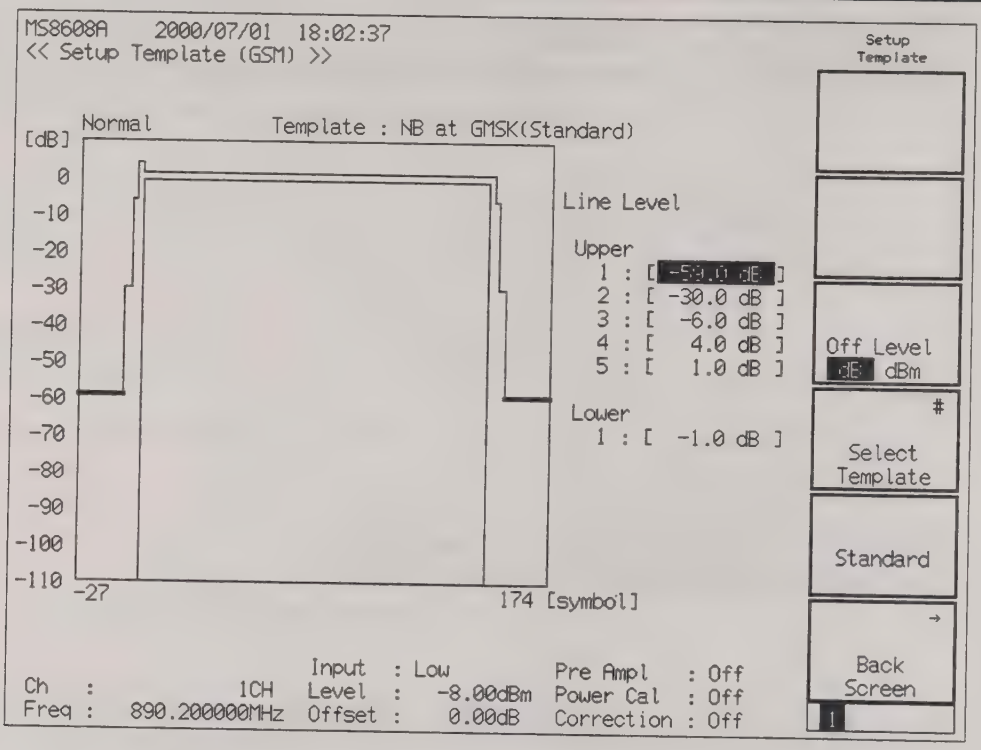
If you set the marker to Normal, a diamond (◆) marker appears on the waveform.

Setting Template (Setup Template)

When measuring the burst signal in relative level mode, a template can be displayed, as follows:

Displaying Setup Template screen

Step	Procedure
1	On the RF Power screen, Press the (F3) (Setup Template) key on the first page of RF Power function label.
2	The Setup Template screen (figure below) appears.



Setting template

Step	Procedure
1	Select the desired specification line with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the specification-line level with the numeric key pad. Or, press the (Set) Entry key.
	If the (Set) key pressed at above, take the followings.
3	The specification changing line is displayed.
4	Set the changing line to the desired level with (∧) and (∨) Entry keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, the specification-line level is changed to the set level.

Setting Off level (Upper-1) unit

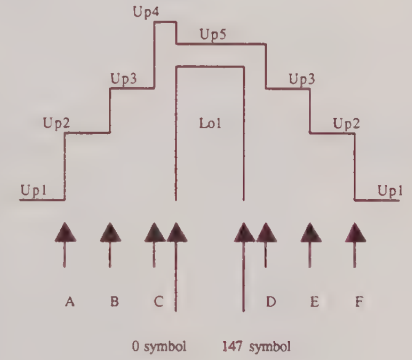
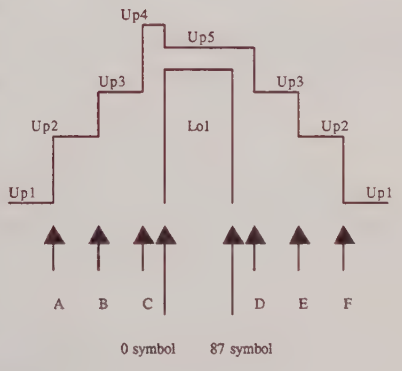
Press the (F3) (Off Level) key to switch the unit between dB and dBm, alternately.

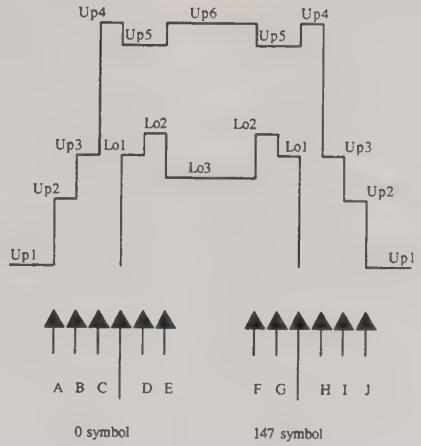
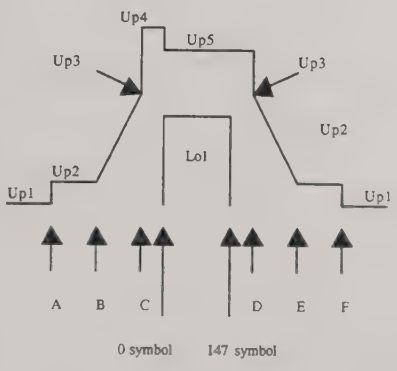
Setting template type

When you press the F4 (Select Template) key, you can select a template from among the four types below.

- NB at GMSk
- AB
- NB at 8PSK
- BTS1900 at GMSK

Each template is as follows:

NB at GMSK Upper - 1: –59 dB or dBm Upper - 2: –30 dB Upper - 3: –6 dB Upper - 4: 4 dB Upper - 5: 1 dB Lower - 1: –1 dB A: 0 symbol–28 µs B: 0 symbol–18 µs C: 0 symbol–10 µs D: 147 symbol+10 µs E: 147 symbol+18 µs F: 147 symbol+28 µs	
AB Upper - 1: –59 dB or dBm Upper - 2: –30 dB Upper - 3: –6 dB Upper - 4: 4 dB Upper - 5: 1 dB Lower - 1: –1 dB A: 0 symbol–28 µs B: 0 symbol–18 µ C: symbol–10 µs D: 87 symbol+10 µs E: 87 symbol+18 µs FÅF87 symbol+28 µs	

NB at 8PSK Upper - 1: –59 dB or dBm Upper - 2: –30 dB Upper - 3: –6 dB Upper - 4: 4 dB Upper - 5: 2.4 dB Upper - 6: 4 dB Lower - 1: –2 dB Lower - 2: 0 dB Lower - 3: –15 dB A: 0 symbol–28 µs B: 0 symbol–18 µs C: 0 symbol–10 µs D: 0 symbol±4 µs E: 0 symbol±2 µs F: 147 symbol–4 µs G: 147 symbol–2 µs H: 147 symbol+10 µs I: 147 symbol+18 µs J: 147 symbol+28 µs	
BTS1900 at GMSK Upper - 1: –30 dB or dBm Upper - 2: –30 dB Upper - 3: –0 dB Upper - 4: 4 dB Upper - 5: 1 dB Lower - 1: –1 dB A: 0 symbol–28 µs B: 0 symbol–18 µs C: 0 symbol–10 µs D: 147 symbol+10 µs E: 147 symbol+18 µs F: 147 symbol+28 µs	

On Pass/Fail judgment by template, the power values at A through J are obtained after linear interpolation of power values at adjacent 1/10 symbol points.

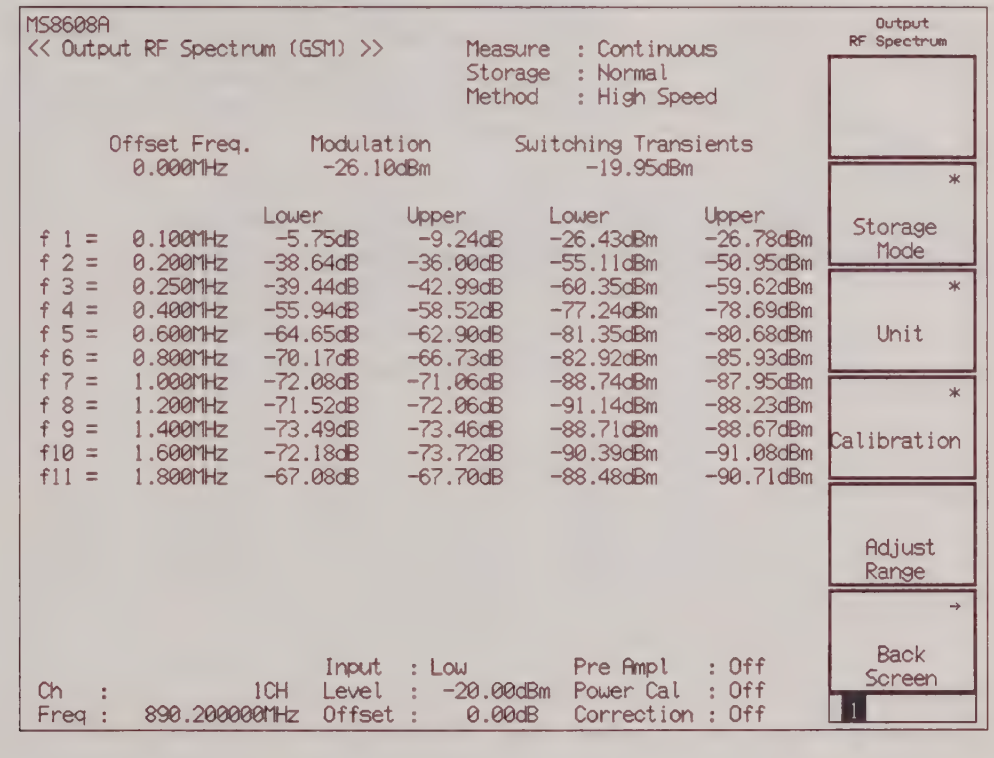
Returning values of template to default values

If you press the F5 (Standard) key, the template returns to the above default (standard) values .

Measuring Output RF Spectrum

This Section explains the measured results and the set parameters, displayed on the Output RF Spectrum screen.

Screen description


MS8608A
<< Output RF Spectrum (GSM) >>
Measure : Continuous
Storage : Normal
Method : High Speed
Offset Freq. 0.000MHz
Modulation -26.10dBm
Switching Transients -19.95dBm
Lower Upper Lower Upper
f 1 = 0.100MHz -5.75dB -9.24dB -26.43dBm -26.78dBm
f 2 = 0.200MHz -38.64dB -36.00dB -55.11dBm -50.95dBm
f 3 = 0.250MHz -39.44dB -42.99dB -60.35dBm -59.62dBm
f 4 = 0.400MHz -55.94dB -58.52dB -77.24dBm -78.69dBm
f 5 = 0.600MHz -64.65dB -62.90dB -81.35dBm -80.68dBm
f 6 = 0.800MHz -70.17dB -66.73dB -82.92dBm -85.93dBm
f 7 = 1.000MHz -72.08dB -71.06dB -88.74dBm -87.95dBm
f 8 = 1.200MHz -71.52dB -72.06dB -91.14dBm -88.23dBm
f 9 = 1.400MHz -73.49dB -73.46dB -88.71dBm -88.67dBm
f10 = 1.600MHz -72.18dB -73.72dB -90.39dBm -91.08dBm
f11 = 1.800MHz -67.08dB -67.70dB -88.48dBm -90.71dBm
Ch : 1CH
Freq : 890.200000MHz
Input : Low
Level : -20.00dBm
Offset : 0.00dB
Pre Ampl : Off
Power Cal : Off
Correction : Off
Output RF Spectrum
Storage Mode
Unit
Calibration
Adjust Range
Back Screen
1

Modulation

Displays the average power in 50 to 90 percent portion, excluding the Training Sequence Code at the frequency detuned by each offset amount from the carrier frequency.

Switching Transient

Displays the peak power at the frequency detuned by each offset amount from the carrier frequency.

Performes the measurement with RBW 30 kHz for an offset frequency between 100 kHz and 1.6 MHz, and with RBW 100 kHz for that of 1.8 MHz.

Setting Storage Mode (Storage Mode)

Set the storage mode for measured results, as follows:

Storage Mode: Select one of the following storage modes:

- Normal: Measured result is updated and displayed at each measurement end.
- Average: Average of measured result is calculated and displayed at each measurement end.

Average Count: Sets the number of the averaged counts.

Refresh Interval: Sets the updating interval for average value display.

- Every: Updated at each measurement end.
- Once: Updated at the measurement end over the number of the averaged counts.

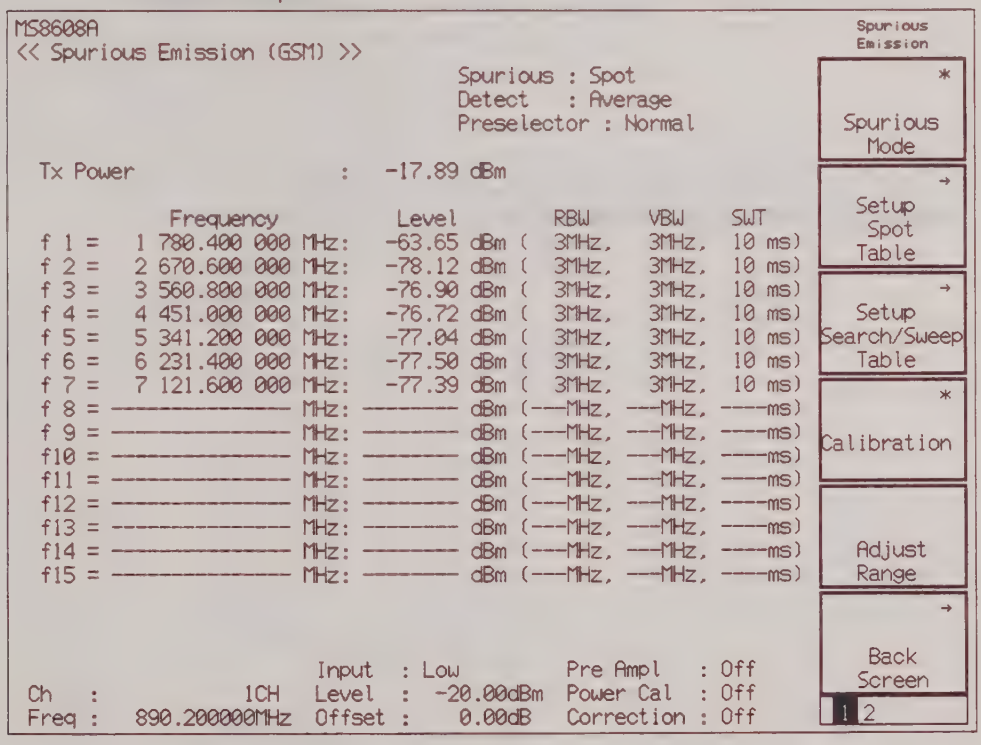
Setting Unit of Switching Transient (Unit)

- Press the [F3] (Unit) key to display the function labels below. Select the unit.
  - [F1] (dBm): Sets the unit to dBm.
  - [F2] (dB): Sets the unit to dB.

Measuring Spurious

This Section explains the measured results and the set parameters displayed on the Spurious Emission screen.

Screen description


MS8608A
<< Spurious Emission (GSM) >>
Spurious Emission
Spurious : Spot
Detect : Average
Preselector : Normal
Tx Power : -17.89 dBm
Frequency Level RBW VBW SWT
f 1 = 1 780.400 000 MHz: -63.65 dBm (3MHz, 3MHz, 10 ms)
f 2 = 2 670.600 000 MHz: -78.12 dBm (3MHz, 3MHz, 10 ms)
f 3 = 3 560.800 000 MHz: -76.90 dBm (3MHz, 3MHz, 10 ms)
f 4 = 4 451.000 000 MHz: -76.72 dBm (3MHz, 3MHz, 10 ms)
f 5 = 5 341.200 000 MHz: -77.04 dBm (3MHz, 3MHz, 10 ms)
f 6 = 6 231.400 000 MHz: -77.50 dBm (3MHz, 3MHz, 10 ms)
f 7 = 7 121.600 000 MHz: -77.39 dBm (3MHz, 3MHz, 10 ms)
f 8 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f 9 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f10 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f11 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f12 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f13 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f14 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
f15 = ---------- MHz: -------- dBm (---MHz, ---MHz, ----ms)
Ch : 1CH
Freq : 890.200000MHz
Input : Low
Level : -20.00dBm
Offset : 0.00dB
Pre Ampl : Off
Power Cal : Off
Correction : Off
Spurious Mode
Setup Spot Table
Setup Search/Sweep Table
Calibration
Adjust Range
Back Screen
1 2

Tx Power

Displays the average power of measured signal during burst-on.

Frequency

Displays the spurious frequency

Level

Displays the spurious level

RBW, VBW, SWT

Displays the RBW, VBW and Sweep-Time measurement conditions of the Spectrum Analyzer.

Setting spurious measurement method (Spurious Mode)

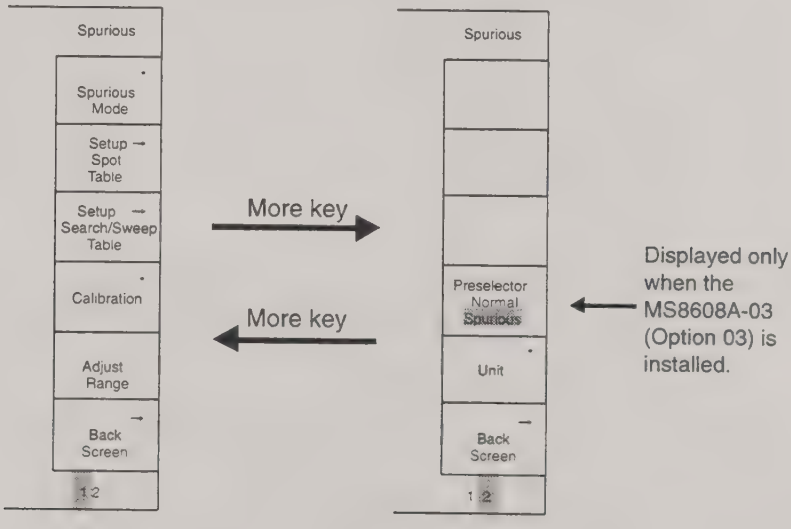
- Press the (F1) (Spurious Mode) key to display the following function labels. Select one of the spurious measurement method.
  - (F1) (Spot): Performs the measurement at the frequency set on the Setup Spot Table with the time domain to obtain the average value.
  - (F2) (Search): Sweeps the frequency range set on the Setup Search/Sweep Table, and performs the Spot measurement at the searched peak frequency.
  - (F3) (Sweep): Sweeps the frequency range set on the Setup Search/Sweep Table, and obtains the frequency and level at each the peak point.

Setting Unit of Spurious Level (Unit)

Set the unit of spurious level, as follows.

Step	Procedure

1 Press the (More) key to display the second page of Spurious function label.



2 Press the (F5) (Unit) key to display the following function label. Select the unit.

- (F1) (dBm): Select the dBm unit.
- (F2) (dB): Select the dB unit.

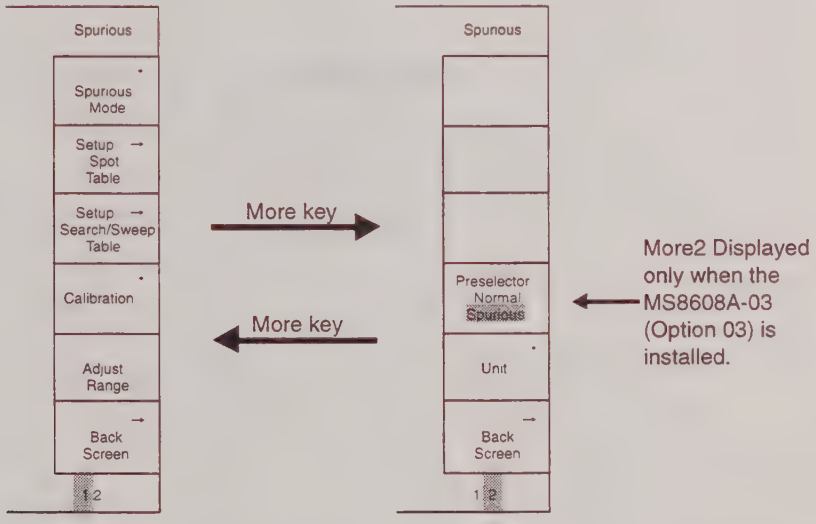
The reference level at dB unit becomes Tx Power.

Setting Mode of Pre-selector (Pre-selector)

This function is available only when the MS8608A-03 (Option 03) is installed. (This option can be installed only on the MS8608A, and not on the MS8609A.)
With this function, you can select whether to use Band 0 (Normal mode) or Band 1 (Spurious mode) to perform measurements in the range from 1.6 GHz to 3.2 GHz.
In Spurious mode, there is no affect by the higher-harmonic frequencies of the Spectrum Analyzer itself, because the sweeping is performed at Band 1 in the measurement range of 1.6 GHz to 3.2 GHz.

Setting mode of pre-selector

Step	Procedure
1	Press the (More) key to display the second page of the Spurious function label.
2	Press the (F5) (Pre-selector) key to switch the pre-selector mode between Normal mode and Spurious mode, alternately.

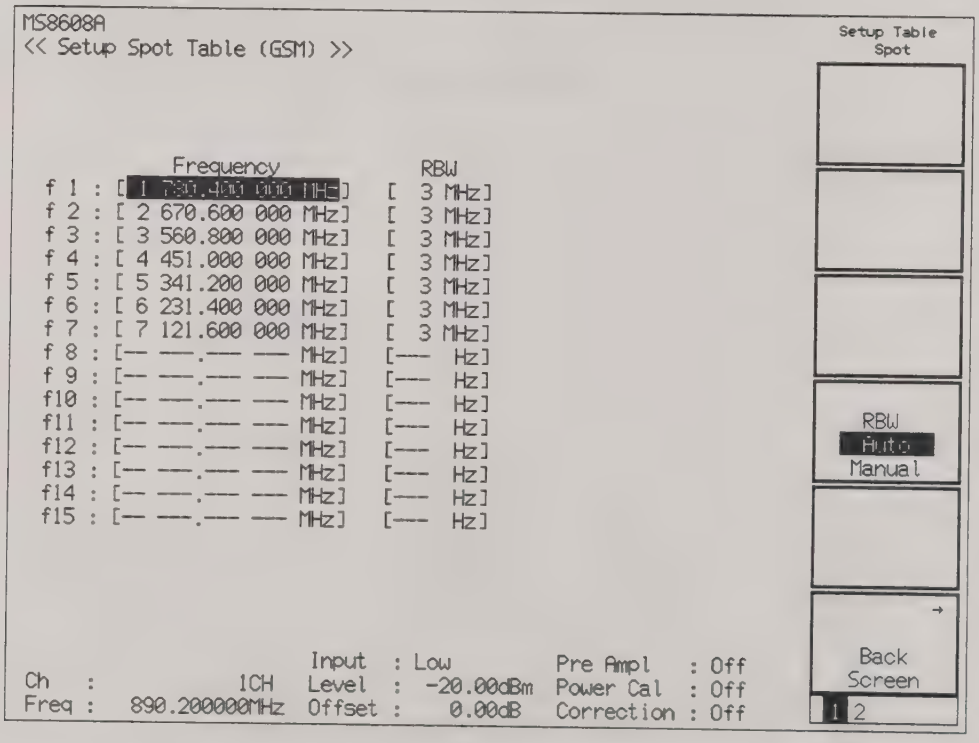


Setting Measurement Frequencies for Spot Method (Setup Spot Table)

This Section explains how to set the measurement frequency used at spot method. The measurement frequencies are set on the Setup Spot Table screen.

Displaying Setup Spot Table screen

Step	Procedure
1	On the Spurious Emission screen, press the (F2) (Setup Spot Table) key on the first page of the Spurious function label.
2	The Setup Spot Table screen (as shown below) appears.


MS8608A
<< Setup Spot Table (GSM) >>
Setup Table Spot
Frequency
RBW
f 1 : [1 780.400 000 MHz] [3 MHz]
f 2 : [2 670.600 000 MHz] [3 MHz]
f 3 : [3 560.800 000 MHz] [3 MHz]
f 4 : [4 451.000 000 MHz] [3 MHz]
f 5 : [5 341.200 000 MHz] [3 MHz]
f 6 : [6 231.400 000 MHz] [3 MHz]
f 7 : [7 121.600 000 MHz] [3 MHz]
f 8 : [-- ---.--- --- MHz] [--- Hz]
f 9 : [-- ---.--- --- MHz] [--- Hz]
f10 : [-- ---.--- --- MHz] [--- Hz]
f11 : [-- ---.--- --- MHz] [--- Hz]
f12 : [-- ---.--- --- MHz] [--- Hz]
f13 : [-- ---.--- --- MHz] [--- Hz]
f14 : [-- ---.--- --- MHz] [--- Hz]
f15 : [-- ---.--- --- MHz] [--- Hz]
RBW
Auto
Manual
Back
Screen
1 2
Ch : 1CH
Freq : 890.200000MHz
Input : Low
Level : -20.00dBm
Offset : 0.00dB
Pre Ampl : Off
Power Cal : Off
Correction : Off

Setting measurement frequency

Step	Procedure
1	Move the cursor to a desired Frequency item with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the frequency with the numeric key pad.

When the setting is completed, the set frequency is displayed in [ ] for specified item.

Setting RBW

Step	Procedure
1	Move the cursor to the desired RBW item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to the desired RBW value with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When the setting is completed, the set RBW is displayed in [ ] for specified item.

Setting RBW, automatically

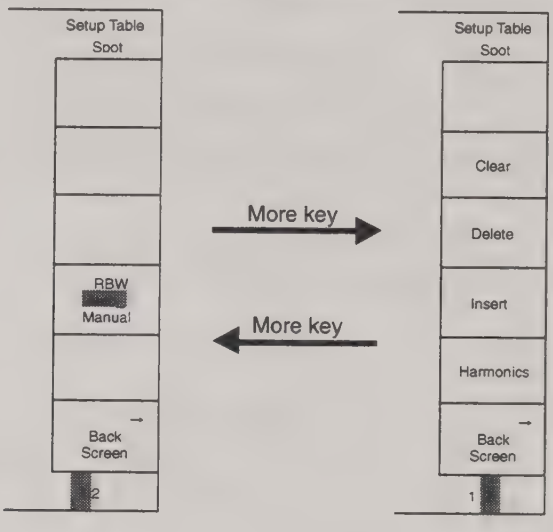
- Press the (F4) (RBW Auto/Manual) key to switch the RBW mode between Auto and Manual, alternately.

When Auto is selected, RBW is set depending on the frequency, as follows.

- 1 kHz: When frequency is in the range of 1 kHz to 100 kHz. (100 kHz is not included.)
- 10 kHz: When frequency is in the range of 100 kHz to 50 MHz. (50 MHz is not included.)
- 100 kHz: When frequency is in the range of 50 MHz to 500 MHz. (500 MHz is not included.)
- 3 MHz: When frequency is equal to or more than 500 MHz.

Setting harmonics

Step	Procedure
1	Press the (More) key to display the second page of Setup Table Spot function label.



2	Press the (F5) (Harmonics) key to automatically set the harmonics of frequency on Setup Common Parameter screen. The previously-set frequency and RBW are all cleared.

Clearing all settings

Step	Procedure
1	Press the (F2) (Clear) key to open the confirmation window for clearing the set values.
2	Move the cursor to Yes with the rotary knob.
3	If you press the (Set) Entry key, the set values are all cleared.

Deleting cursor line

Step	Procedure
1	Press the (F3) (Delete) key to delete the line at the cursor, and all lines after the cursor line are moved upward by one line.

Inserting a blank line into cursor line

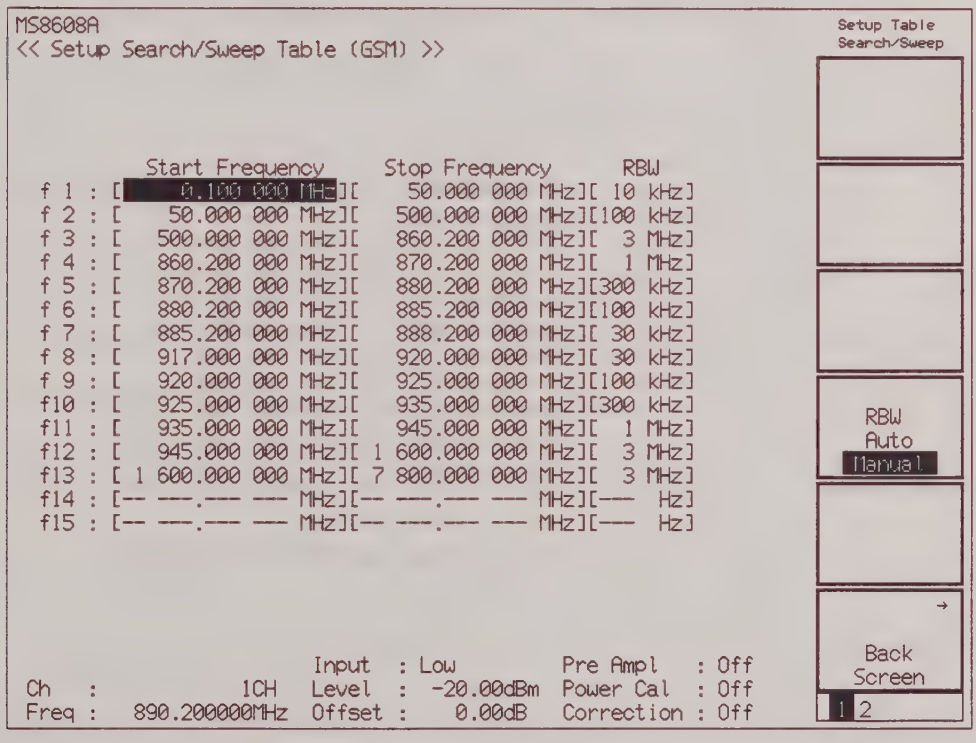
Step	Procedure
1	Press the (F4) (Insert) key to insert a blank line, and all lines after the cursor line are moved downward by one line. If f15 is set, no blank lines can be inserted.

Setting Sweep Range for Search-method/Sweep-method (Setup Search/Sweep Table)

This Section explains how to set the sweep range for measurement in Search or Sweep method. The sweep range is set on the Setup Search/Sweep Table screen.

Displaying Setup Search/Sweep Table screen

Step	Procedure
1	On the Spurious Emission screen, press the (F3) (Setup Search/Sweep Table) key on the first page of the Spurious function label.
2	Setup Search/Sweep Table screen (figure below) is displayed.



Setting Start Frequency and Stop Frequency

Step	Procedure
1	Move the cursor to a desired Start/Stop Frequency with (∧) and (∨) Entry keys or with the rotary knob.
2	Set the frequency with the numeric key pad.

When setting is completed, the set frequency is displayed in [ ] for specified item. Start Frequency is always separated by more than 1 kHz from Stop Frequency. For example, if you set the Stop Frequency to 100 kHz when the Start Frequency is 100 kHz, the Start Frequency is automatically changed to 99 kHz.

Setting RBW

Step	Procedure
1	Move the cursor to the desired RBW item with (∧) and (∨) Entry keys or with the rotary knob.
2	Press the (Set) Entry key.
3	The window for selection opens.
4	Move the cursor to the desired RBW value with (∧) and (∨) keys or with the rotary knob.
5	Press the (Set) key.

When setting is completed, the set RBW is displayed in [ ] for specified item.

Setting RBW, automatically

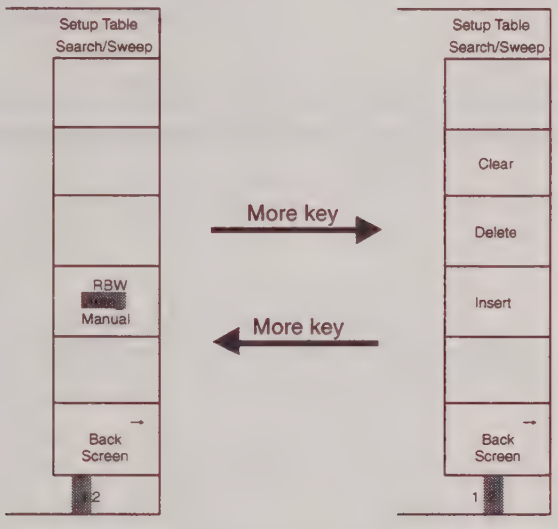
- Press the (F4) (RBW Auto/Manual) key to switch the RBW mode between Auto and Manual, alternately.

When Auto is selected, RBW is set depending on the Start Frequency, as follows.

- 1 kHz: When start frequency is in the range of 1 kHz to 100 kHz. (100 kHz is not included.)
- 10 kHz: When start frequency is in the range of 100 kHz to 50 MHz. (50 MHz is not included.)
- 100 kHz: When start frequency is in the range of 50 MHz to 500 MHz. (500 MHz is not included.)
- 3 MHz: When start frequency is equal to or more than 500 MHz.

Clearing all settings

Step	Procedure
1	Press the More key to display the second page of the Setup Table Search/Sweep function label.



2	Press the F2 (Clear) key to open the confirmation window for clearing all the set values.
3	Move the cursor to Yes with the rotary knob.
4	Press the Set Entry key to clear all the set values.

Deleting cursor line

Step	Procedure
1	Press the F3 (Delete) key to clear the line at cursor, and all the lines after the cursor line are moved upward by one line.

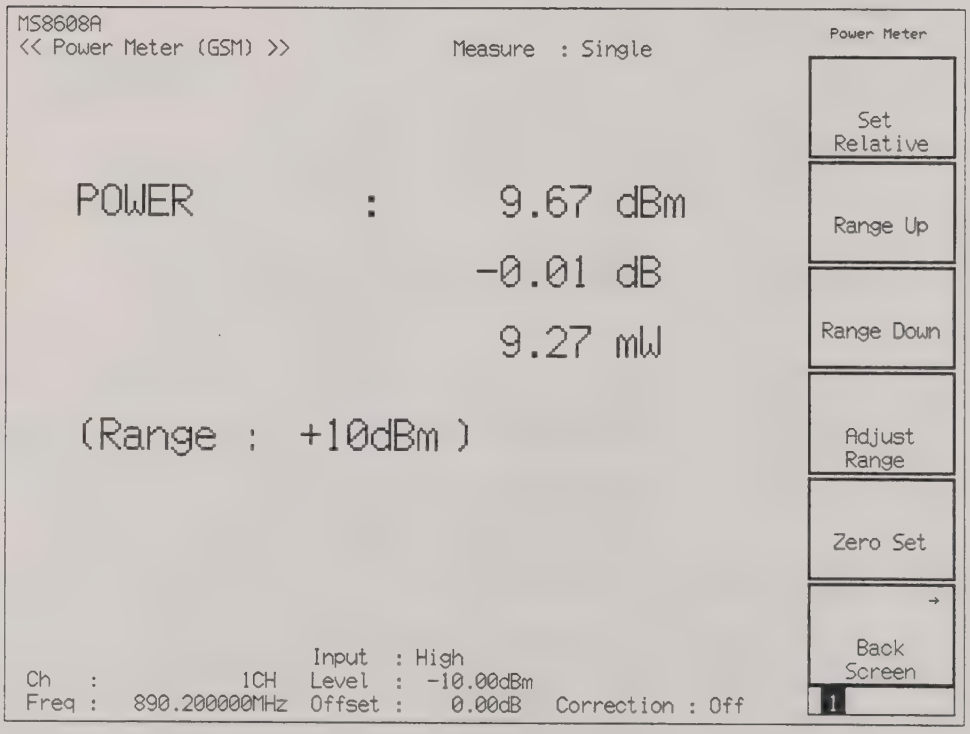
Inserting a blank line into cursor line

Step	Procedure
1	Press the F4 (Insert) key to insert a blank line at cursor, and all the lines after the cursor line are moved downward by one line. If f15 is set, no blank lines can be inserted.

Power Meter

The measurement result displayed in the Power Meter screen and the parameters to be set in the screen are explained here.

Screen Description



POWER

Displays the power measured by the internal power sensor in dBm, relative level and W-system.

The relative level is displayed assuming the measured value (at the time that F1 (Set Relative) key is pressed) as the reference value.

Range

Displays current measurement range.

Calibrating zero point (Zero Set)

For high-precision measurement, perform the zero point calibration.
Turn off the input power to the RF input connector, and then press (F5) (Zero Set) to calibrate the zero-input power point.

Setting reference value for relative value display (Set Relative)

Set the reference value for relative value display, as below.

- Pressing (F1) (Set Relative) sets the measured power at this time as the reference value.

Setting measurement range (Range Up/Range Down)

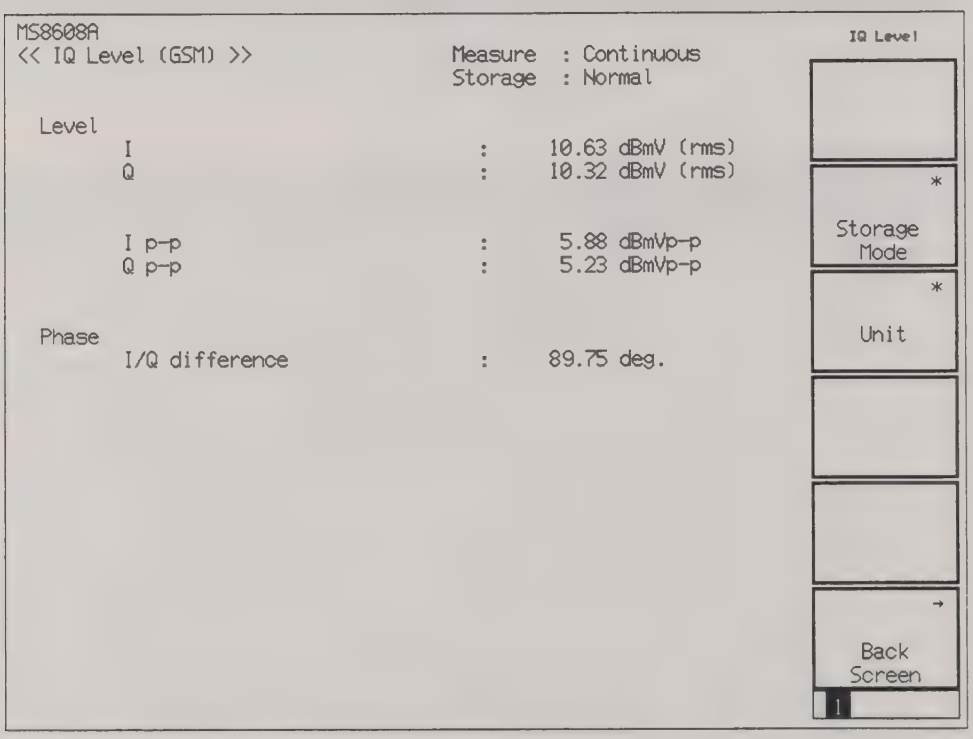
Set the measurement range for the power meter using the following methods.

- Pressing (F2) (Range Up) shifts up the measurement range.
- Pressing (F3) (Range Down) shifts down the measurement range.
- Pressing (F4) (Adjust Range) optimizes the measurement range according to the input power. At the same time, reference level on Setup Common Parameter screen is set to the optimal value.

Measuring IQ Level

The measurement result displayed in the IQ Level screen and the parameters to be set in the screen are explained here.

Screen Description



Level (I and Q)

Displays the effective value levels of the I- and Q-phase signals.

Level (Ip-p and Qp-p)

Displays the peak-to-peak levels of the I- and Q-phase signals.

Phase (I/Q difference)

Displays the phase difference between the I- and Q-phase signals when a CW signal is input to the I and Q input connectors.

Setting storage mode (Storage Mode)

Sets the storage mode for the measured results.

Storage Mode: Storage mode can be selected from the items below.

- Normal: Updates the result and displays it after each measurement.
- Average: Averages the result and displays the averaged value after each measurement.

Average Count: Sets the number of averaging times.

Refresh Interval: Sets the interval for refreshing the averaged value display.

- Every: Refreshes the averaged value after each measurement.
- Once: Refreshes the averaged value after the number of measurements set for the Average Count.

Setting level unit (Unit)

- Pressing F3 (Unit) displays the function labels below. Select the unit to be used.
  - F1 (mV): Set the unit to mV.
  - F2 (dBmV): Set the unit to dBmV.

Saving and Recalling Set Parameters

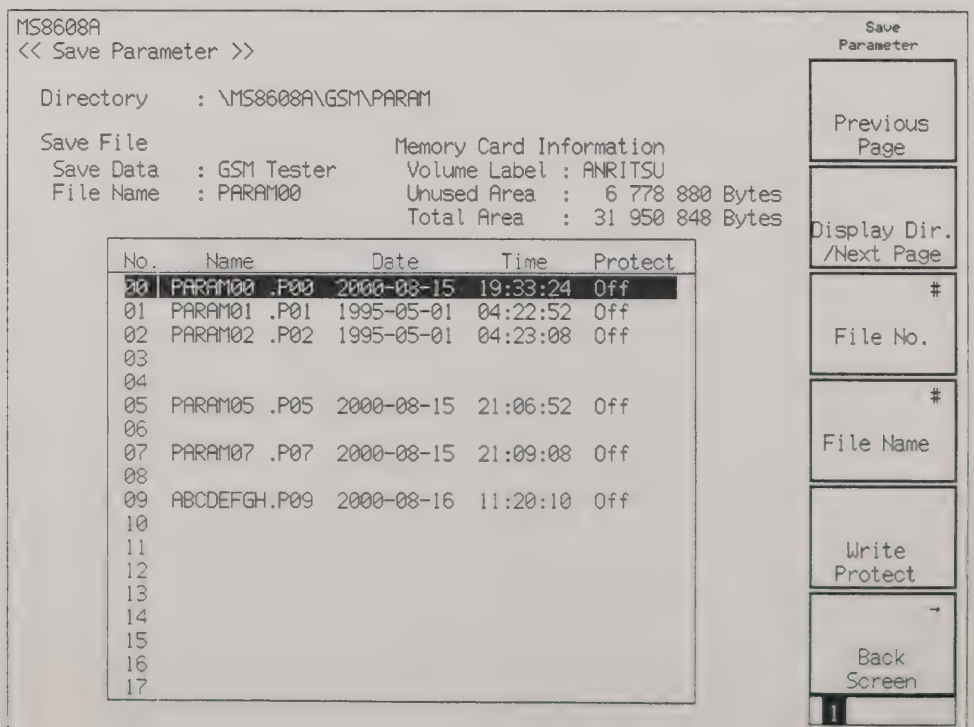
How to save/recall the set parameter values on/from the memory card is explained here.
First, insert the memory card into the memory card slot. The memory card must be inserted/removed while the main unit power is on. However, do not insert/remove the memory card during saving/recalling process.

100 setting files can be saved on one memory card. The files are saved with the number from 0 to 99. Alphanumeric filenames or the write protection can be used for them. Name the files according to the MS-DOS filename format. Up to 8 characters can be used but not case-sensitive.

Saving parameters (Save)

To save the set parameters, display the Save Parameter screen by following the steps below:

Step	Procedure
1	Insert the memory card into the memory card slot.
2	Press the (Shift) key, and then press the (Recall) key.
3	Press (F2) (Display Dir.).



100 setting files (states) can be saved on one memory card. The files are saved with the numbers from 0 to 99.

4 Move the cursor using (∧) and (∨) Entry keys or the rotary knob to select the file number. Or press (F3) (File No.) to open the setting window and input the file number using the numeric keypad.

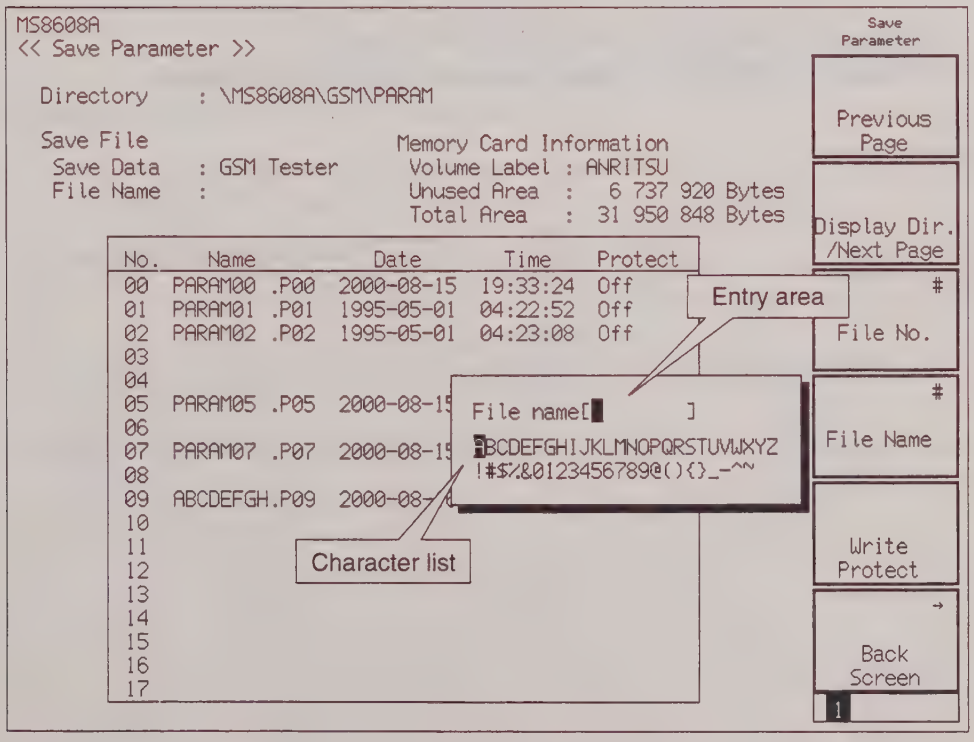
5 Press the (Set) Entry key.

6 The confirmation window opens. Select "Yes" and press the (Set) Entry key.

This saves the set value for each parameter on the memory card.
When a file is saved for a new number, it is automatically named as "PARAM**.P**" (** equals to the file number). If a file is saved for an existing file number, the file is overwritten but the filename is not changed.

Saving file with new name (File No.)

In Step 4 in [Saving Parameters], pressing (F4) (File Name) enables saving a file with a new name.
This section explains the mean of filename input with the filename input window displayed by pressing (F4) (File Name).



1	Select the character to be input on the character list by moving the cursor using the rotary knob.
2	Press the (Enter) key. The selected character is written on the entry area.
3	Enter the filename by repeating Steps 1 and 2. The characters from A to F and the numbers from 0 to 9 can be entered using the numeric keypad. Up to 8 characters can be used in a filename. Only the characters displayed in the character list can be used in a filename. The other characters cannot be used.
4	After entering the filename, press the (Set) Entry key.
5	A confirmation window opens. Select "Yes" and press the (Set) key.

Then, the file is saved with a new name.
Followings are the summary of each operation used for inputting new name.

- Rotary knob: Move the cursor in the character list.
- (∧) (∨): Moves the cursor in the entry area.
- (BS): Deletes a character on the left of the cursor in the entry area.
- (Enter): The character at the cursor position in the character list overwrites the character at the cursor position in the entry area.
- (Set): Sets the character string in the entry area as the filename.

Write-protecting file (Write Protect)

The setting method for write-protection of a file is explained here.

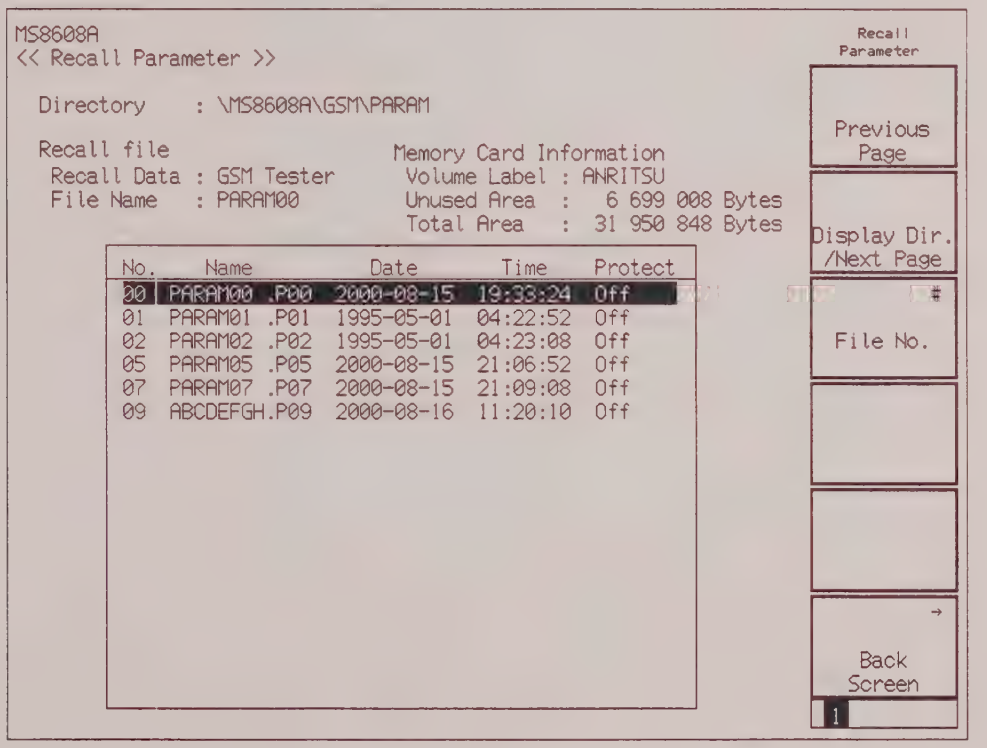
Step	Procedure
1	Using the (∧) and (∨) Entry keys or the rotary knob, move the cursor onto the file number of which file is to be write-protected.
2	Press (F5) (Write Protect).

Pressing (F5) (Write Protect) switches write-protection on/off.

Recalling parameters (Recall)

To recall the saved parameters, display the Recall Parameter screen by following the steps below:

Step	Procedure
1	Insert the memory card into the memory card slot.
2	Press the (Recall) key.
3	Press (F2) (Display Dir.) key.



Step	Procedure
4	Move the cursor using the (∧) and (∨) Entry keys or the rotary knob to select the file number to be recalled. Or press (F3) (File No.) key to open the file number setting window, and input the file number using the numeric keypad.
5	Press the (Set) Entry key.
6	The confirmation window opens. Select "Yes" and press the (Set) key.

After recalling the parameters, the screen moves to the Setup Common Parameter screen.

Section 4 Performance Test

This section describes measuring instruments, how to set up them and operating details to conduct the performance test for GSM measurement by installing the MX860802A in the MS8608A/MS8609A.

( ) in this section means a panel key.

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Requirement for Performance Test

The performance test described here is conducted as part of preventive maintenance against performance deterioration during GSM measurement by installing the MX860802A in the MS8608A/MS8609A.
Use the performance test on the MS8608A/MS8609A with the MX860802A when it is needed for the receiving inspection, periodic inspection or post-repair performance check.
The items that are determined to be critical should be periodically tested (once or twice a year or so is desirable) as preventive maintenance.
Perform the following performance tests for receiving inspection, periodic inspection and post-repair performance check when the MS8608A/MS8609A is used for GSM measurement.

- Modulation/frequency measurement
- Transmission power measurement accuracy
- Power measurement at carrier off
- Linearity
- Output spectrum measurement
- Spurious measurement
- IQ input modulation accuracy
- Power meter accuracy

If any item that does not satisfy specifications is found by the performance test, contact Anritsu or our agency.

List of Equipment Required for Performance Test

The list of measuring instruments for the performance test is shown below.

Recommended instrument name (model name)	Performance requirement	Test item
Synthesized signal generator (MG3633A)	• Frequency range: 100 kHz to 2,700 MHz 1 Hz of resolution available • Output level range: –20 to +10 dBm 0.1 dB of resolution available • SSB phase noise: –130 dBc/Hz or less (for 10 kHz offset) • Second harmonic: –30 dBc or less • External reference input: possible (10 MHz)	Modulation/frequency analysis Transmission power measurement accuracy Linearity Output spectrum measurement Spurious measurement Power meter accuracy
Digital modulation signal generator (MG3672A+ MG0302A+MG0303B)	• Frequency range: 50 MHz to 2,700 MHz 1 Hz of resolution available • Output level range Non-modulation: –10 to +10 dBm Modulation: –20 to +4 dBm 0.1 dB of resolution available • External reference input: possible (10 MHz)	Power measurement range at carrier off IQ input modulation accuracy (GMSK modulation)
Digital modulation signal generator	• IQ output possible • EDGE signal output possible • Output level: 0.1 to 1.0 V (rms) • S/N: 50 dB or more • External reference input: possible (10 MHz)	IQ input modulation accuracy (8PSK modulation)
Calibration receiver (ML2530A)	• Frequency range: 100 kHz to 3 GHz 1 Hz of resolution available • Measuring power range: –140 to 20 dBm • Measurement accuracy: ±0.04 dB • External reference input: possible (10 MHz)	Linearity Power meter accuracy
Power meter (ML4803A) Power sensor (MA4601A)	• Main unit accuracy: ±0.02 dB • Frequency range: 100 kHz to 8.5 GHz (depending on power sensor in use) Power meter accuracy • Frequency range: 10 MHz to 3 GHz • Measuring power range: –30 to +20 dBm • Input connector: N type	Modulation/frequency analysis Transmission power measurement accuracy Linearity Power meter accuracy
Fixed attenuator (MP721A)	• Attenuation: 3 dB • VSWR: 1.2 or less	Power meter accuracy

Recommended instrument name (model name)	Performance requirement	Test item
Programmable attenuator (MN72A)	• Frequency range: DC to 18 GHz • Attenuation accuracy: 0.9 dB • VSWR: 1.2 or less Power meter accuracy	Modulation/frequency measurement Transmission power measurement accuracy Linearity Power meter accuracy
LPF switching unit	• Facility to cut off the second harmonic component of 850 MHz and to pass through filter	Spurious measurement
2G LPF	• Facility to cut off the higher harmonics (more than 2 GHz) generated by the signal generator	Spurious measurement

Performance requirements are excerpted from a part of the performance that covers the measurement range of test items.

Performance Test

Warm up the devices to be tested and measuring instruments for at least 30 minutes unless otherwise specified. After the devices are stabilized, execute the performance test.

To obtain the optimal measurement accuracy, in addition to the above instructions, the test should be conducted at room temperature (25 ±5 °C) and there must be little fluctuation in the AC power voltage and no problem with noise, vibration, dust, humidity, etc.

Modulation/Frequency Measurement

Tests for the following specifications are conducted here:

- Frequency measurement accuracy
- Residual phase error
- Residual EVM

(1) Specifications to be tested

- Frequency measurement accuracy: ± (accuracy of the standard crystal oscillator +10 Hz)

  Input level (average power within burst):

  ≥ –10 dBm (High Power input)

  ≥ –30 dBm (Low Power input)

  ≥ –30 dBm (Low Power input, Pre-amplifier On *1)
- Residual phase error (GMSK modulation): <0.5 degrees (rms)

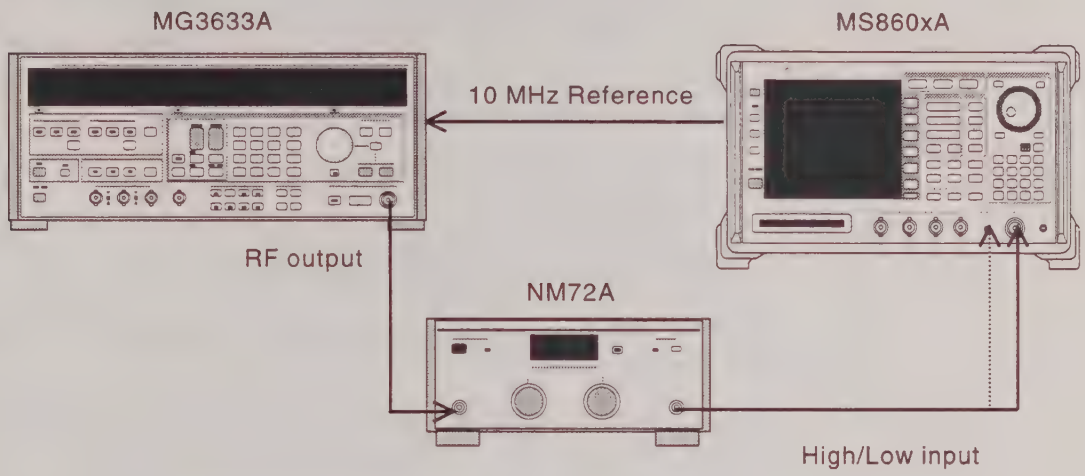
  <2.0 degrees (peak)
- Residual EVM (8PSK modulation): <1.0 % (rms)

*1: Pre-amplifier can be set to On when the main unit Option 08 is installed.

(2) Measuring instrument for test

- Synthesized signal generator (SG1): MG3633A
- Programmable attenuator: MN72A

(3) Setup



(4) Test procedures

Step	Procedure

1 With SG1 in non-modulation state, set the frequency to be measured. Set the programmable attenuator (MN72A) to 0 dB. Frequencies to be measured and measurement levels are shown in the following table:

Frequency	Level (input level to the MS860xA)		
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A	High Power input of MS8608A
50 MHz	–40 dBm±0.1 dB	–30 dBm±0.1 dB	–10 dBm±0.1 dB
850 MHz	–40 dBm±0.1 dB	–30 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–40 dBm±0.1 dB	–30 dBm±0.1 dB	–10 dBm±0.1 dB
2700 MHz	–40 dBm±0.1 dB	–30 dBm±0.1 dB	–10 dBm±0.1 dB

2 Set the MS8608A/MS8609A as follows:

- Input Terminal: RF(High/Low Power Input)
- Reference Level: –10 dBm
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Continuous
- Trigger: Free Run

3 Press (More) to display the second page of the function label.

4 Press (F6) (Power Meter) to move to the Power Meter screen.

5 Set the output of SG1 to off and execute (F5) (Zero Set).

Step	Procedure
6	Set the output of SG1 to –10 dBm and execute (F4) (Adjust Range). Adjust the level of SG1 so that the Power Meter reads –10 dBm ±0.1 dB (Adjust Range must always be executed after the SG1 level is varied). When the level calibration is completed, press (F6) (Back Screen).
7	Set the programmable attenuator (MN72A), as follows. • At Pre-amplifier On: 30 dB • At MS8609A and Low Power input of MS8608A: 20 dB • At High Power input of MS8608A: 0 dB
8	Set the SG1 setting frequency to the sum of 67.70833 kHz (a quarter of the Bit Rate) plus the value in the above table.
9	Press (F2) (Modulation Analysis) of the MS8608A/MS8609A to move to the Modulation Analysis screen. Press (F5) (Adjust Range) to perform Adjust Range.
10	Check that the frequency error value and the residual phase error value satisfy the specifications.
11	Set the SG1 setting frequency to the sum of 50.78125 kHz plus the value in the table on the previous page.
12	Set Modulation of the MS8608A/MS8609A to 8PSK. (Set the programmable attenuator, the same as Step 7 above.)
13	Execute Step 9 in the same manner and then check that the residual EVM satisfies the specifications.
14	Repeat Steps 1 thru 13, after changing the frequency.

Transmission Power Measurement Accuracy

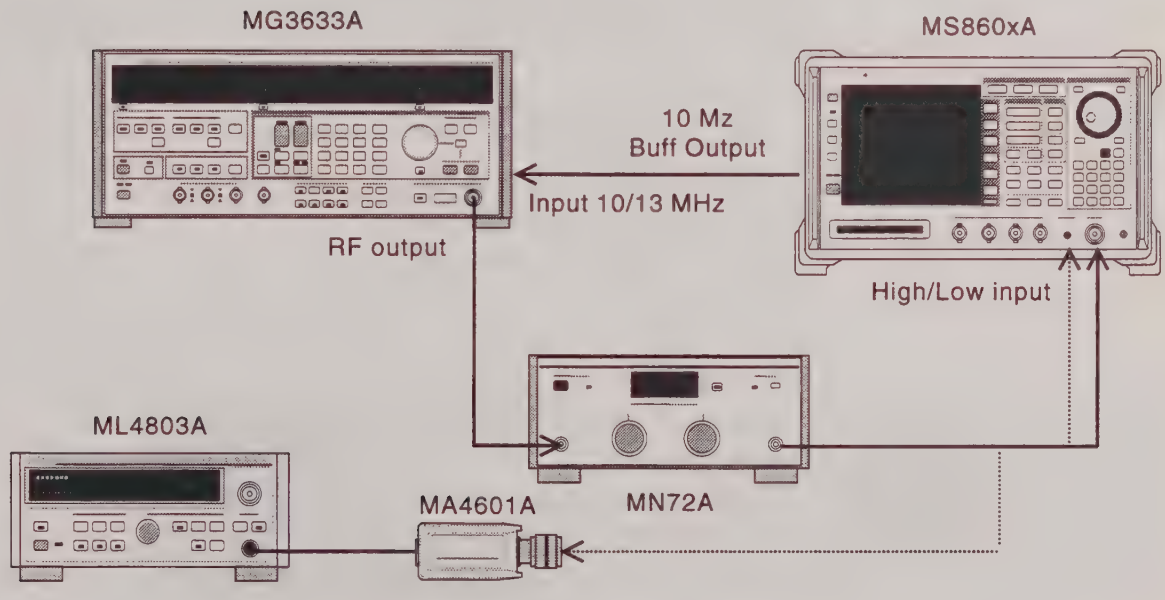
(1) Specifications to be tested

±0.4 dB (after calibration using the built-in power meter)

(2) Measuring instrument for test

- Synthesized signal generator (SG1): MG3633A
- Power meter: ML4803A
- Power sensor: MA4601A
- Programmable attenuator: MN72A

(3) Setup



(4) Test procedures

Step	Procedure
1	Connect the power sensor (MA4601A) to Cal Output of the power meter (ML4803A), and execute Zero Adjust.
2	Set the Sensor Input to On, and execute ADJ (Cal Adjust).
3	Connect SG1 (MN72A output) to the power sensor (MA4601A).

Step	Procedure

4 Set the frequency and the output level of SG1, as follows.
Adjust the SG1 level so that the power meter (ML4803A) reads +10 dBm±0.1 dB, and record the measured results.
Then, with the programmable attenuator (MN72A) set to 20 dB, measure and record the attenuation amount for every frequencies. Combinations of frequencies to be measured and measurement levels are shown in the following table:

Frequency	Level (input level to the MS860xA)		
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A	High Power input of MS8608A
50 MHz	–10 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
850 MHz	–10 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–10 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
2700 MHz	–10 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB

5 Connect SG1 (MN72A output) to the MS8608A/MS8609A.

6 Set the MS8608A/MS8609A as follows:
- Input Terminal: RF (High/Low Power Input)
- Reference Level: (Level in the above table)
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Continuous
- Trigger: Free Run

7 Set the programmable attenuator (MN72A), as follows.
- At Pre-amplifier On: 20 dB
- At MS8609A and Low Power input of MS8608A: 20 dB
- At High Power input of MS8608A: 0 dB

8 Press [F3] (RF Power)to move to the RF Power screen.

9 Press [F5] (Adjust Range).

10 Press [More] to display the second page of the function label.

11 Press [F5] (Calibration) and execute [F1] (Power Calibration).

12 Record the TX Power value (dBm), as follows.
- For High Power input of MS8608A
  Measurement accuracy [dB] = TX Power value – the value obtained from the power meter
- At Pre-amplifier On, and Low Power input of MS860xA
  Measurement accuracy [dB] = TX Power value – (the value obtained from the power meter – true attenuation when MN72A ATT is set to 20 dB)

13 Repeat Steps 3 thru 12, after changing the frequency.

Power Measurement at Carrier Off

(1) Specifications to be tested

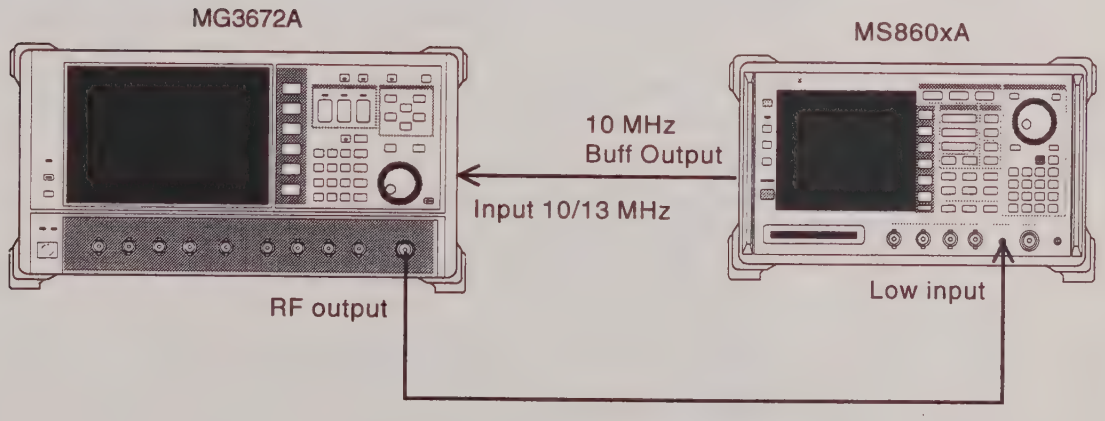
- Input level (average power within burst):
  ≥+10 dBm (High Power input)
  ≥–10 dBm (Low Power input)
  ≥–20 dBm (Low Power input, Pre-amplifier On *1)
- Measurement range in the normal mode : (60 dB (compared to the average power within burst)
- Measurement range in the wide dynamic range mode:
  Average power within burst: Compared to 1W (High Power input) and 10 mW (Low Power input)
  ≥70 dB (the measurement lower limit is determined by the average noise level: ≤–50 dBm (High Power input, 50 MHz to 2.7 GHz))

*1: Pre-amplifier can be set to On when the main unit Option 08 is installed.

(2) Measuring instrument for test

- Digital signal generator (SG2): MG3672A with MG0302A & MG0303B

(3) Setup



(4) Test procedures

Step	Procedure

1 Set SG2 as follows:

- System: GSM
- Differential Encode: On
- Phase Polarity: Normal
- Burst: On
- Pattern: TCH
- Trigger: Int

2 Set the SG2 frequency, as shown on the table below.
Set the SG2 output level to –10 dBm.
The input level to the MS8608A/MS8609A is measured by the TX Power value on the RF Power screen (set Wide Dynamic Range to off).
Combinations of frequencies and levels to be measured are shown in the following table:

Frequency	Level (input level to the MS860xA)	
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A
50 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
850 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
2700 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB

3 Set the MS8608A/MS8609A as follows:

- Input Terminal: RF (Low Power input only for MS8608A)
- Reference Level: (Level in the above table)
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Normal Burst
- Trigger: Free Run

4 Press (F3) (RF Power) to move to the RF Power screen.

5 Press (F5) (Adjust Range).

6 Press (More) to display the second page of the function label.

7 Press (F5) (Calibration) and execute (F1) (Power Calibration).

8 Press (Single) and adjust the level of SG2 so that the TX Power value reads –10 dBm ±0.1 dB. (Never execute Adjust Range operation after the level is varied.)

* When Pre-amplifier is set to On, calibrate the SG2 level so that the TX Power reads –20 dBm ±0.1 dB (at this time, execute Adjust Range).

Step	Procedure
9	Check that On/Off Ratio satisfies the specifications.
10	Turn back the function label to the first page, and press (F4) (Wide Dynamic Range) to set it On (at both the times of Low Power input and Pre-amplifier On).
11	Adjust the SG2 output level so that the input level to the MS8608A/MS8609A becomes 0 dBm by reading the TX Power on the RF Power screen, and execute (F5) (Adjust Range).
12	Press (More) to display the second page of the function label.
13	Press (F5) (Calibration) and execute (F1) (Power Calibration).
14	Measure Carrier OFF power and check that the absolute value of OFF power does not exceed the specified average noise level ≤–71 dBm at Low Power input).
15	Repeat Steps 2 thru 14, after changing the frequency.

Linearity

(1) Specifications to be tested

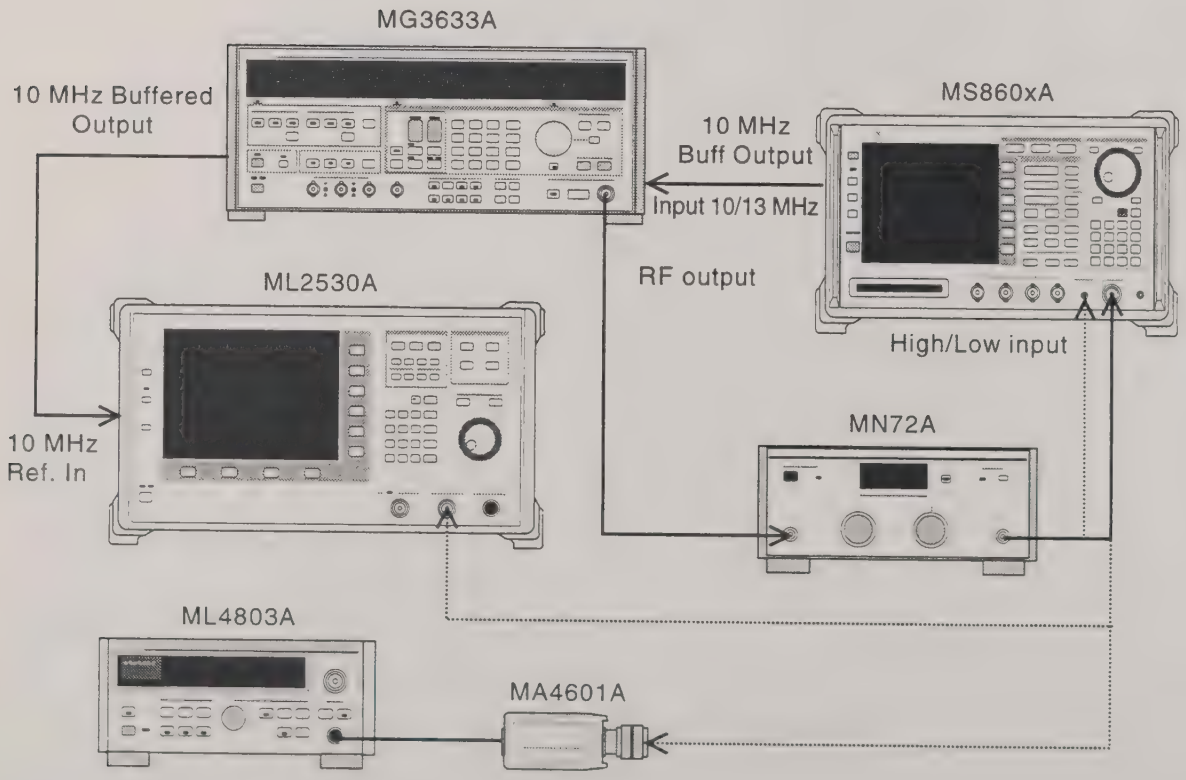
±0.2 dB (0 to –30 dB)

In the state of not changing the reference level setting after performing Adjust Range operation

(2) Measuring instrument for test

- Synthesized signal generator (SG1): MG3633A
- Calibration receiver: ML2530A
- Programmable attenuator: MN72A
- Power meter: ML4803A
- Power sensor: MA4601A

(3) Setup



(4) Test procedures

Step	Procedure

1 Connect the power sensor (MA4601A) to Cal Output of the power meter (ML4803A), and execute Zero Adjust.

2 Set Sensor Input to On, and execute ADJ (Cal Adjust).

3 Connect SG1 (MN72A output) to the power sensor (MA4601A).

4 Set the SG1 frequency as shown on the table below, and set the programmable attenuator (MN72A) to 0 dB.
Adjust the SG1 level so that the power meter (ML4803A) reads +10 dBm ±0.1 dB, and record the set value (using Set_Ref).
Combinations of the frequencies and levels to be measured are shown in the following table:

Frequency	Level (input level to the MS860xA)		
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A	High Power input of MS8608A
50 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
850 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB
2700 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB	–10 dBm±0.1 dB

5 Connect SG1 (MN72A output) to the calibration receiver (ML2530A), and set BW to 100 Hz and Relative mode (fix the range to 1).

6 Decrease the SG1 output level to –30 dBc (compared to Set_Ref) in 10 dB decrements, recording each measured value (ML2530A reading) by the calibration receiver (ML2530A).

7 Set the MS8608A/MS8609A as follows:
- Input Terminal: RF (High/Low Power Input)
- Reference Level: (Level in the above table)
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Continuous
- Trigger: Free Run

8 Set the programmable attenuator (MN72A), as below.
- At Pre-amplifier On: 30 dB
- At MS8609A and Low Power input of MS8608A: 20 dB
- At High Power input to MS8608A: 0 dB

9 Connect SG1 (MN72A output) to the MS8608A/MS8609A, and set the output level of the signal generator to Set_Ref.

10 Press F3 (RF Power) to move to the RF Power screen.

11 Press F5 (Adjust Range).

Step	Procedure
12	Press (More) to display the second page of the function label.
13	Press (F5) (Calibration) and execute (F1) (Power Calibration).
14	Record the TX Power value (dBm) (Measure_Ref).
15	Decrease the SG1 output level to –30 dBc (compared to Set_Ref) in 10 dB decrements, recording the TX Power value each time. ***Note:*** Vary the SG1 level by 10 dB decrement. Don't vary the setting of the programmable attenuator (MN72A).
16	Check that the linearity error (shown below) satisfies the specifications. Linearity error [dB] = TX Power value – (Measure_Ref – ML2530A reading)
17	Repeat Steps 3 thru 16, after changing the frequency.

Output Spectrum Measurement

(1) Specifications to be tested

- For CW signal input

  Measurement range of the modulation section

  ≥60 dB (≥200 kHz of detuning)

  ≥68 dB (≥250 kHz of detuning)

  (at <1.8 MHz of detuning, RBW: 30 kHz)

  (at (1.8 MHz of detuning, RBW: 100 kHz)

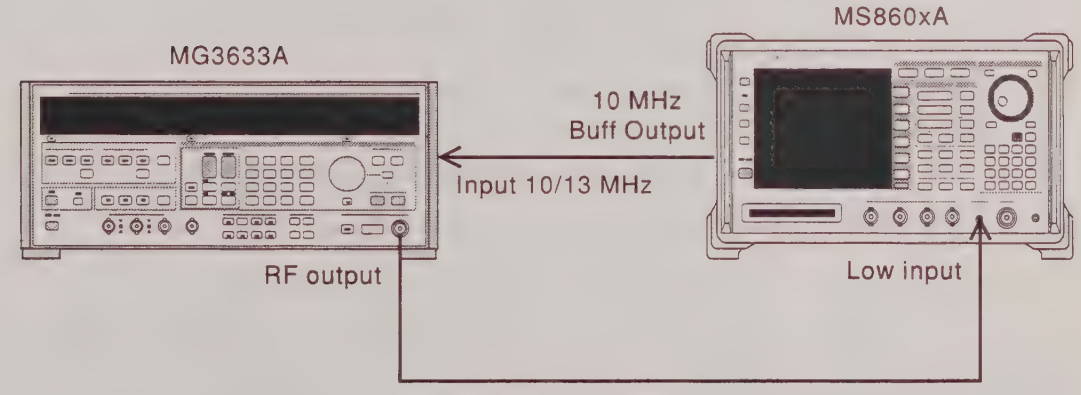
  Measurement range of the transient section

  ≥63 dB (≥400 kHz of detuning)

(2) Measuring instrument for test

- Synthesized signal generator (SG1): MG3633A

(3) Setup



(4) Test procedures

Step	Procedure

1 With SG1 in non-modulation state, set the frequency and the output level, as shown below. The input level is measured with the built-in power meter of the MS8608A/MS8609A. Combinations of the frequencies and levels to be measured are shown in the following table:

Frequency	Level (reading of power meter function)	
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A
50 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
850 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
2700 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB

2 Set the MS8608A/MS8609A as follows:
- Input Terminal: RF (Low Power input only for MS8608A)
- Reference Level: (Level in the above table)
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Continuous
- Trigger: Free Run

3 Press (More) to display the second page of the function label.

4 Press (F6) to move to the Power Meter screen.

5 Set the SG1 output to Off, and execute (F5) (Zero Set).

6 Set the SG1 output level to the level in the above table, and execute (F4) (Adjust Range), as below.

Adjust the SG1 level so that the Power Meter reads the level in the above table (Adjust Range must always be executed after the SG1 level is varied).

7 When the level calibration is completed, press (F6) (Back Screen).

8 Return the function label to the first page; press (F5) (Output RF Spectrum) to move to the Output RF Spectrum screen.

9 Press (F3) (Unit) and then (F2) (dB) to change the unit display to dB.

10 Press (F6) (Return) and then execute (F5) (Adjust Range).

11 Press (F4) (Calibration) and execute (F1) (Power Calibration).

12 Check that the modulation and transient section measurement ranges satisfy the specifications.

13 Repeat Steps 1 thru 12, after changing the frequency.

Spurious Measurement

(1) Specifications to be tested

- Measurement range

  At 800 MHz to 1 GHz and 1.8 to 2 GHz of carrier frequencies

  ≥ 72 dB (RBW: 10 kHz)

  (1 to 50 MHz, band 0)

  ≥72 dB (RBW: 100 kHz)

  (50 to 500 MHz, band 0)

  ≥67 – f [GH] dB (RBW: 3 MHz)

  (500 MHz to 3.15 GHz, band 0, normal mode, excluding higher harmonic frequencies)

  ≥66 dB (RBW: 3 MHz)

  (3.15 to 7.8 GHz, band 1, normal mode)

  At Option 03 installed

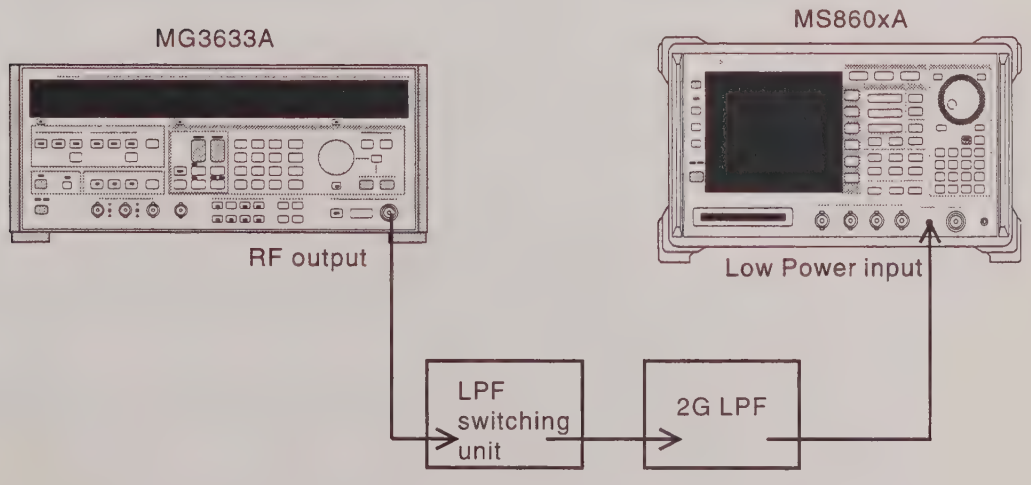
  ≥66 dB (RBW: 3 MHz)

  (3.15 to 7.8 GHz, band 1, spurious mode)

(2) Measuring instrument for test

- Synthesized signal generator (SG1): MG3633A
- LPF switching unit (able to cut off the second harmonic component of 850 MHz and to pass through filter)
- 2G LPF

(3) Setup



(4) Test procedures

Step	Procedure

1 Set the frequency and output level of SG1, as below.
The input level to the MS8608A/MS8609A is measured with the built-in power meter.
Combinations of the frequencies and levels to be measured are shown in the following table:

Frequency	Level (reading of power meter function)	
	MS860xA Pre-amplifier On	MS8609A and Low Power input of MS8608A
850 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB
1800 MHz	–20 dBm±0.1 dB	–10 dBm±0.1 dB

2 Set the MS8608A/MS8609A as follows:
- Input Terminal: RF (Low Power input only for MS8608A)
- Reference Level: (Level in the above table)
- Frequency: (Frequency in the above table)
- Modulation: GMSK
- Measuring Object: Continuous
- Trigger: Free Run

3 Press (More) to display the second page of the function label.

4 Press (F6) (Power Meter) to move to the Power Meter screen.

5 Set the SG1 output to Off, and execute (F5) (Zero Set).

6 Set the SG1 output level to the level in the above table, and execute (F4) (Adjust Range). Adjust the level of the signal generator (SG1) so that the Power Meter reads the level in the above table (Adjust Range must always be executed after the SG1 level is varied).

7 When the level calibration is completed, press (F6) (Back Screen).

8 Set the LPF switching unit as follows:
a) Carrier Frequency: 850 MHz
   - Set LPF to 1.1 GHz.

b) Carrier Frequency: 1,800 MHz
   - Set LPF to Filter Pass (no Filter).

9 Turn back the function label to the first page, and press (F6) (Spurious Emission) to move to the Spurious Emission screen.

10 Press (F1) (Spurious Mode) and set (F3) (Sweep). When setting is completed, press [F6] (Return).

Step	Procedure
11	Press (F3) (Setup Search/Sweep Table) and set the frequency table as shown below: a) For Carrier Frequency: 850 MHz • Set Table 1.0. b) For Carrier Frequency: 1,800 MHz • Set Table 2.0. When setting is completed, press (F6) (Back Screen).
12	Press (More) to display the second page of the function label. Press (F4) (Preselector) and set Normal mode.
13	Return the function label to the first page. ***Note:*** Setting Steps 12 and 13 are possible only when Option 03 is installed.
14	Execute (F5) (Adjust Range).
15	Press (F4) (Calibration) and execute (F1) (Power Calibration).
16	Check that the measurement range satisfies the specifications.
17	When Option 03 is installed, make the following Steps 18 to 24, as well. When Option 03 is not installed, repeat Steps 1 thru 16, after changing the frequency.
18	Press (F3) (Setup Search/Sweep Table) and then (More) to display the second page of the function label.
19	Press (F2) to clear the frequency table.
20	Set the frequency table as shown below: c) For Carrier frequency: 850 MHz • Set Table 1.1. d)For Carrier frequency: 1,800 MHz • Set Table 2.1.
21	Press (More) to display the second page of the function label. Press (F4) (Preselector) and set to Spurious mode.
22	Return the function label to the first page.
23	Execute Steps 14 to 16 in the same manner.
24	Repeat Steps 1 thru 23, after changing the frequency.

Table1.0

	Start Frequency	Stop Frequency	RBW
f1	100 kHz	50 MHz	10 kHz
f2	50 MHz	500 MHz	100 kHz
f3	500 MHz	800 MHz	3 MHz
f4	900 MHz	1650 MHz	3 MHz
f5	1750 MHz	2500 MHz	3 MHz
f6	2600 MHz	3200 MHz	3 MHz
f7	3200 MHz	7800 MHz	3 MHz

Table1.1

	Start Frequency	Stop Frequency	RBW
f1	1600 MHz	3150 MHz	3 MHz

Table2.0

	Start Frequency	Stop Frequency	RBW
f1	100 kHz	50 MHz	10 kHz
f2	50 MHz	500 MHz	100 kHz
f3	500 MHz	850 MHz	3 MHz
f4	950 MHz	1750 MHz	3 MHz
f5	1850 MHz	3200 MHz	3 MHz
f6	3200 MHz	7800 MHz	3 MHz

Table2.1

	Start Frequency	Stop Frequency	RBW
f1	1600 MHz	1750 MHz	3 MHz
f2	1850 MHz	3150 MHz	3 MHz

IQ Input Modulation Accuracy

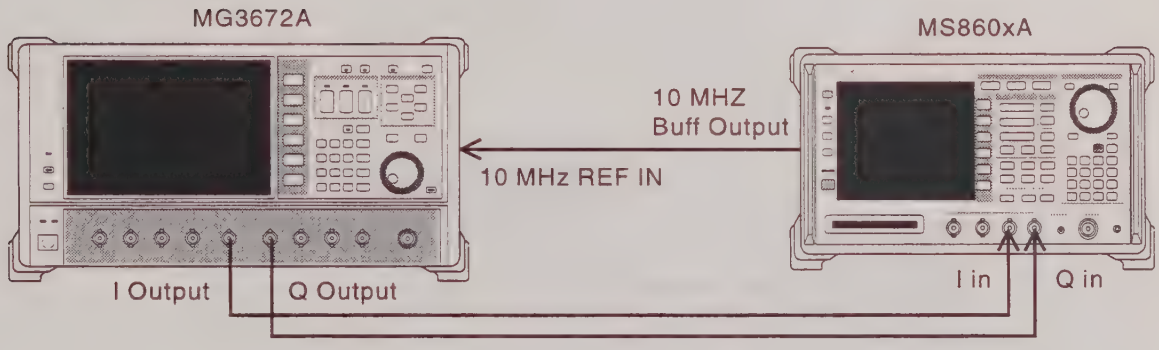
(1) Specifications to be tested

- Residual phase error (GMSK modulation)
  <0.5 degrees (rms) (DC coupling)
- Residual EVM (8PSK modulation)
  <1.0% (rms) (DC coupling)

(2) Measuring instrument for test

- Digital signal generator: MG3672A with MG0302A & MG0303B

(3) Setup



(4) Test procedures

Step	Procedure
1	Set the MG3672A as follows: • System: GSM • Differential Encode: On • Phase Polarity: Normal • Burst: On • Pattern: TCH • Trigger: Int
2	Set the MS8608A/MS8609A as follows: • Input Terminal: IQ-DC • Impedance: 50 Ω • Modulation: GMSK • Measuring Object: Normal Burst • Pattern: TSC1 • Trigger: Free Run
3	Press [F1] (Modulation Analysis) to move to the Modulation Analysis screen.
4	Check that the residual phase error (RMS phase error) satisfies specifications.
5	Set the signal data of the digital signal generator to EDGE.
6	Set the MS8608A/MS8609A as follows: • Modulation: 8PSK • Measuring Object: Normal Burst • Pattern: (Match the signal source)
7	Press [F1] (Modulation Analysis) to move to the Modulation Analysis screen.
8	Press [F4] (Filter) and set [F3] (Nyquist & Inverse).
9	Check that the residual EVM value (EVM) satisfies specifications.

Power Meter Accuracy

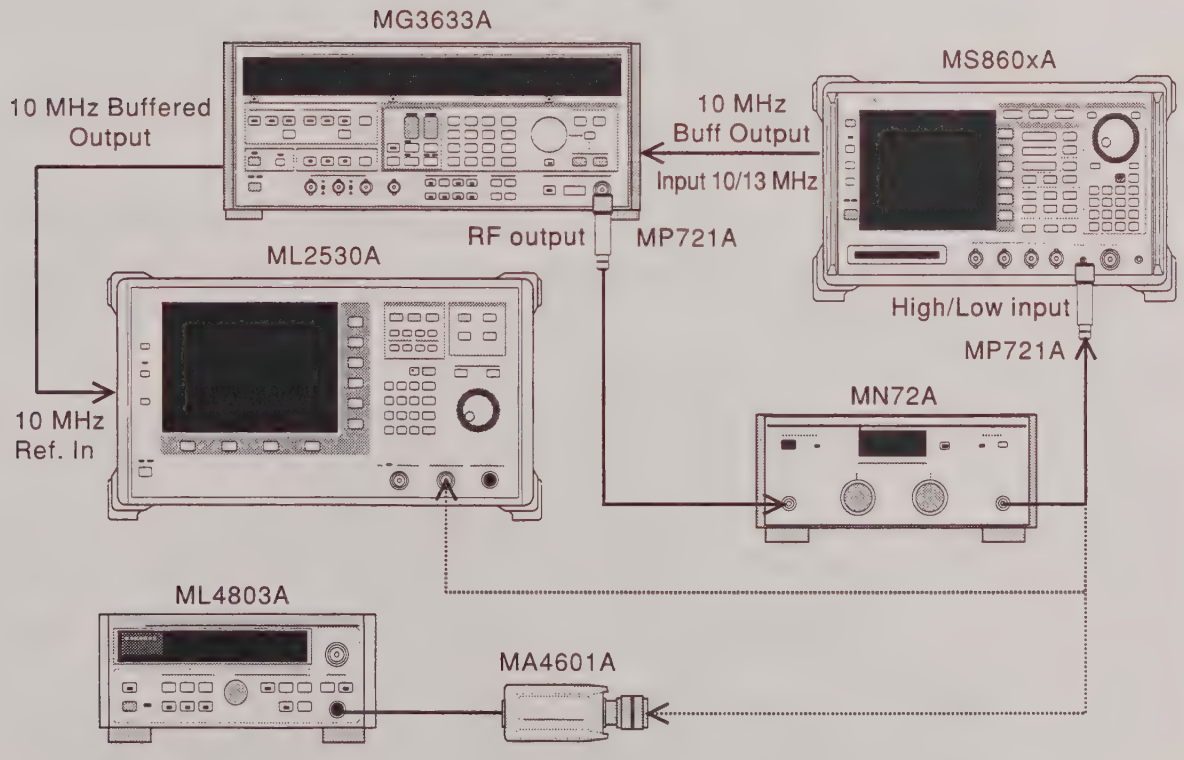
(1) Specifications to be tested

- Measurement level accuracy
  ±10% (after zero-point calibration)

(2) Measuring instrument for test

- Signal generator (SGI): MG3633A
- Calibration receiver: ML2530A
- Power meter: ML4803A
- Power sensor: MA4601A
- Programmable attenuator: MN72A
- 3 dB ATT × 2 pieces: MP721A

(3) Setup



(4) Test procedures

Step	Procedure
1	Connect the power sensor (MA4601A) to Cal Output of the power meter (ML4803A), and execute Zero Adjust.
2	Set Sensor Input to On, and execute ADJ (Cal Adjust).
3	Connect the SG1 (through MP721A and MN72A) to the power sensor (MA4601A).
4	Set the SG1 frequency, as below. Measurement frequencies : 50 MHz, 2000 MHz, 3000 MHz
5	Adjust the SG1 level so that the power meter (ML4803A) at each the set frequency reads +10 dBm ±0.1 dB, and record the set value of SG1 (Set_Ref) and the power meter reading (Read_Ref).
6	Connect the SG1 (through MP721A and MN72A) to the calibration receiver (ML2530A) and set the SG1 level to the previous (Set_Ref) value.
7	Set the calibration receiver (ML2530A) to the Relative mode (fix the range to 1). Decrease the programmable attenuator (MN72A) to –30 dB in 10 dB decrements, while recording the measured value of the ML2530A for each attenuation amount (ATT_n). When recording is completed, return the MN72A to 0 dB.
8	Press (More) of the MS8608A/MS8609A to display the second page of the function label.
9	Press (F6) (Power Meter) to move to the Power Meter screen.
10	While no signal is being input to the MS8608A/MS8609A, execute (F5) (Zero Set).
11	Connect SG1 (through MP721A and MN72A) to the MS8608A/MS8609A (through MP721A).
12	Set the MS8608A/MS8609A's frequency to that set in Step 4.
13	Decrease the programmable attenuator (MN72A) to –30 dB in 10 dB decrements, while recording the measured value of the MS8608A/MS8609A (Tester) for each attenuation amount (measured value of Tester). Calculate the power-meter measurement accuracy (shown below) with the 3 measured values of the power meter reading (Read_Ref), measured value of ML2530A (ATT_n), and this measured value of Tester. Note that (F4) (Adjust Range) must be executed every time the programmable attenuator is varied. $$\text{Power-meter measurement accuracy [\%]} = \left(\frac{10^{(\text{Measured value of Tester}/10)}}{10^{(\text{Read\_Ref} + \text{ATT\_n})/10}} - 1 \right) \times 100$$ ***Note:*** ATT_n is a minus value.
14	Repeat Steps 4 thru 13, after changing the frequency.

Example of Entry Form for Performance Test Results

This is an example of entry form that can be filled out with the test results when conducting the performance test for the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester.
Copy this entry form to use for the performance test.

Test location: _____ Report No.: _____
_____ Date: _____
_____ Tested by: _____

Tested instrument name: MS8608A/MS8609A Digital Mobile Radio Transmitter Tester
MX860802A/MX860902A GSM Measurement Software

Serial number: _____ Ambient temperature: _____ °C
Power frequency: _____ Hz Relative humidity: _____ %

Remarks: _____
_____
_____

Modulation/Frequency Measurement

Frequency/modulation measurement accuracy (High Power input)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Residual phase error (rms)	Minimum value	0 deg. (rms)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	0.45 deg. (rms)			
	Measurement uncertainty	0.05 deg. (rms)			
Residual phase error (peak)	Minimum value	0 deg. (peak)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	1.8 deg. (peak)			
	Measurement uncertainty	0.2 deg. (peak)			
Residual EVM	Minimum value	0 % (rms)			
	Actual measured value	____ % (rms)	____ % (rms)	____ % (rms)	____ % (rms)
	Maximum value	0.8 % (rms)			
	Measurement uncertainty	0.2 % (rms)			
Carrier frequency accuracy	Minimum value	–9.9 Hz			
	Actual measured value	____ Hz	____ Hz	____ Hz	____ Hz
	Maximum value	+9.9 Hz			
	Measurement uncertainty	±0.1 Hz			

Frequency/modulation measurement accuracy (Low Power input)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Residual phase error (rms)	Minimum value	0 deg. (rms)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	0.45 deg. (rms)			
	Measurement uncertainty	0.05 deg. (rms)			
Residual phase error (peak)	Minimum value	0 deg. (peak)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	1.8 deg. (peak)			
	Measurement uncertainty	0.2 deg. (peak)			
Residual EVM	Minimum value	0 % (rms)			
	Actual measured value	____ % (rms)	____ % (rms)	____ % (rms)	____ % (rms)
	Maximum value	0.8 % (rms)			
	Measurement uncertainty	0.2 % (rms)			
Carrier frequency accuracy	Minimum value	–9.9 Hz			
	Actual measured value	____ Hz	____ Hz	____ Hz	____ Hz
	Maximum value	+9.9 Hz			
	Measurement uncertainty	±0.1 Hz			

Frequency/modulation measurement accuracy (Low Power input, Pre-amplifier On)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Residual phase error (rms)	Minimum value	0 deg. (rms)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	0.45 deg. (rms)			
	Measurement uncertainty	0.05 deg. (rms)			
Residual phase error (peak)	Minimum value	0 deg. (peak)			
	Actual measured value	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)	____ deg.(rms)
	Maximum value	1.8 deg. (peak)			
	Measurement uncertainty	0.2 deg. (peak)			
Residual EVM	Minimum value	0 % (rms)			
	Actual measured value	____ % (rms)	____ % (rms)	____ % (rms)	____ % (rms)
	Maximum value	0.8 % (rms)			
	Measurement uncertainty	0.2 % (rms)			
Carrier frequency accuracy	Minimum value	–9.9 Hz			
	Actual measured value	____ Hz	____ Hz	____ Hz	____ Hz
	Maximum value	+9.9 Hz			
	Measurement uncertainty	±0.1 Hz			

Transmission Power Measurement Accuracy

Power meter reading

		50 MHz	850 MHz	1800 MHz	2700 MHz
Power meter reading	Upper limit	+10.1 dBm			
	Reading	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Lower limit	–9.9 dBm			

True attenuation amount of MN72A Programmable Attenuator (attenuation from +10dBm)

ATT set value	50 MHz	850 MHz	1800 MHz	2700 MHz
20	_____ dBm	_____ dBm	_____ dBm	_____ dBm

Transmission power measurement accuracy (High Power input)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Measurement accuracy	Maximum value	+0.23 dBm			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Minimum value	–0.23 dBm			
	Measurement uncertainty	±0.17 dBm			

Measurement accuracy [dB] = TX Power value – Power meter reading

Transmission power measurement accuracy (Low Power input)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Measurement accuracy	Maximum value	+0.23 dBm			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Minimum value	–0.23 dBm			
	Measurement uncertainty	±0.17 dBm			

Measurement accuracy [dB] = TX Power value – (Power meter reading – True attenuation amount of MN72A ATT when set to 20 dB)

Transmission power measurement accuracy (Low Power input, Pre-amplifier On)

		50 MHz	850 MHz	1800 MHz	2700 MHz
Measurement accuracy	Maximum value	+0.23 dBm			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Minimum value	–0.23 dBm			
	Measurement uncertainty	±0.17 dBm			

Measurement accuracy [dB] = TX Power value – (Power meter reading – True attenuation amount of MN72A ATT when set to 20dB)

Accuracy of the Power Measurement at Carrier Off

Power measurement accuracy (Low Power input)

		50 MHz	850 MHz	1800 MHz	2700 MHz
On/Off Ratio (WDR_Off)	Upper limit	-----			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Lower limit	60 dB			
	Measurement uncertainty	2 dB			
Off Power (WDR On)	Upper limit	–72 dB			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Lower limit	----			
	Measurement uncertainty	2 dB			

Power measurement accuracy (Low Power input, Pre-amplifier On)

		50 MHz	850 MHz	1800 MHz	2700 MHz
On/Off Ratio (WDR_Off)	Upper limit	-----			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Lower limit	60 dB			
	Measurement uncertainty	2 dB			
Off Power (WDR On)	Upper limit	–72 dB			
	Actual measured value	_____ dBm	_____ dBm	_____ dBm	_____ dBm
	Lower limit	----			
	Measurement uncertainty	2 dB			

Linearity

SG1 set value at +10 dBm calibration on each frequency

		50 MHz	850 MHz	1800 MHz	2700 MHz
SG1 set value	Set_Ref	_____dBm	_____dBm	_____dBm	_____dBm

Linearity accuracy (High Power input)

Frequency (MHz)	SG level (dBm)	Calibration receiver reading (dB)	Tester measured value (dBm)	Linearity calculated value (dB)*2	Effective range (dB)
50	+10	-----	_____dBm*1		
	0	_____dB	_____dBm	_____dB	±0.16 dB
	–10	_____dB	_____dBm	_____dB	±0.16 dB
	–20	_____dB	_____dBm	_____dB	±0.16 dB
850	+10	-----	_____dBm*1		
	0	_____dB	_____dBm	_____dB	±0.16 dB
	–10	_____dB	_____dBm	_____dB	±0.16 dB
	–20	_____dB	_____dBm	_____dB	±0.16 dB
1800	+10	-----	_____dBm*1		
	0	_____dB	_____dBm	_____dB	±0.16 dB
	–10	_____dB	_____dBm	_____dB	±0.16 dB
	–20	_____dB	_____dBm	_____dB	±0.16 dB
2700	+10	-----	_____dBm*1		
	0	_____dB	_____dBm	_____dB	±0.16 dB
	–10	_____dB	_____dBm	_____dB	±0.16 dB
	–20	_____dB	_____dBm	_____dB	±0.16 dB
Measurement uncertainty		±0.04 dB			

Linearity accuracy (Low Power input)

Frequency (MHz)	SG level (dBm)	Calibration receiver reading (dB)	Tester measured value (dBm)	Linearity calculated value (dB)*2	Effective range (dB)
50	–10	-----	_____ dBm*1		
	–20	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
850	–10	-----	_____ dBm*1		
	–20	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
1800	–10	-----	_____ dBm*1		
	–20	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
2700	–10	-----	_____ dBm*1		
	–20	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
Measurement uncertainty		±0.04 dB			

Linearity accuracy (Low Power input, Pre-amplifier On)

Frequency (MHz)	SG level (dBm)	Calibration receiver reading (dB)	Tester measured value (dBm)	Linearity calculated value (dB)*2	Effective range (dB)
50	–20	-----	_____ dBm*1		
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–50	_____ dB	_____ dBm	_____ dB	±0.16 dB
850	–20	-----	_____ dBm*1		
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–50	_____ dB	_____ dBm	_____ dB	±0.16 dB
1800	–20	-----	_____ dBm*1		
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–50	_____ dB	_____ dBm	_____ dB	±0.16 dB
2700	–20	-----	_____ dBm*1		
	–30	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–40	_____ dB	_____ dBm	_____ dB	±0.16 dB
	–50	_____ dB	_____ dBm	_____ dB	±0.16 dB
Measurement uncertainty		±0.04 dB			

*1: Measure_Ref

*2: Calculation method of the linearity value:

Linearity calculated value (dB) = Tester measured value (dBm) – {Measure_Ref (dBm) – Calibration receiver measured value(dB)}

Output Spectrum Measurement

Measurement range of modulation section (Low Power input)

	Detuning frequency	100 MHz	850 MHz	1800 MHz	2700 MHz	Measurement uncertainty	Effective lower limit
f1	100 kHz	____ dB	____ dB	____ dB	____ dB	1 dB	61 dB
f2	200 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f3	250 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f4	400 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f5	600 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f6	800 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f7	1 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f8	1.2 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f9	1.4 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f10	1.6 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f11	1.8 MHz	____ dB	____ dB	____ dB	____ dB		69 dB

Measurement range of transient section (Low Power input)

	Detuning frequency	100 MHz	850 MHz	1800 MHz	2700 MHz	Measurement uncertainty	Effective lower limit
f4	400 kHz	____ dB	____ dB	____ dB	____ dB	1 dB	64 dB
f5	600 kHz	____ dB	____ dB	____ dB	____ dB		64 dB
f6	800 kHz	____ dB	____ dB	____ dB	____ dB		64 dB
f7	1 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f8	1.2 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f9	1.4 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f10	1.6 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f11	1.8 MHz	____ dB	____ dB	____ dB	____ dB		64 dB

Measurement range of modulation section (Low Power input, Pre-amplifier On)

	Detuning frequency	100 MHz	850 MHz	1800 MHz	2700 MHz	Measurement uncertainty	Effective lower limit
f1	100 kHz	____ dB	____ dB	____ dB	____ dB	1 dB	61 dB
f2	200 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f3	250 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f4	400 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f5	600 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f6	800 kHz	____ dB	____ dB	____ dB	____ dB		69 dB
f7	1 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f8	1.2 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f9	1.4 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f10	1.6 MHz	____ dB	____ dB	____ dB	____ dB		69 dB
f11	1.8 MHz	____ dB	____ dB	____ dB	____ dB		69 dB

Measurement range of transient section (Low Power input, Pre-amplifier On)

	Detuning frequency	100 MHz	850 MHz	1800 MHz	2700 MHz	Measurement uncertainty	Effective lower limit
f4	400 kHz	____ dB	____ dB	____ dB	____ dB	1 dB	64 dB
f5	600 kHz	____ dB	____ dB	____ dB	____ dB		64 dB
f6	800 kHz	____ dB	____ dB	____ dB	____ dB		64 dB
f7	1 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f8	1.2 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f9	1.4 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f10	1.6 MHz	____ dB	____ dB	____ dB	____ dB		64 dB
f11	1.8 MHz	____ dB	____ dB	____ dB	____ dB		64 dB

Spurious Measurement

Measurement range [Carrier Frequency: 850 MHz] (Low Power input)

	Measurement frequency range	Measurement frequency	Measured value (dB)	Measurement uncertainty	Effective lower limit
f1	100 k to 50 MHz	____ Hz	____ dB	1 dB	73 dB
f2	50 M to 500 MHz	____ Hz	____ dB		73 dB
f3	500 M to 800 MHz	____ Hz	____ dB		73 dB
f4	900 MHz to 1.65 GHz	____ Hz	____ dB		(67-f) dB
f5	1.75 to 2.5 GHz	____ Hz	____ dB		(67-f) dB
f6	2.6 to 3.2 GHz	____ Hz	____ dB		(67-f) dB
f7	3.2 to 7.8 GHz	____ Hz	____ dB		67 dB
f1*1	1.6 to 7.8 GHz	____ Hz	____ dB		67 dB

Measurement range [Carrier Frequency: 1800 MHz] (Low Power input)

	Measurement frequency range	Measurement frequency	Measured value (dB)	Measurement uncertainty	Effective lower limit
f1	100 k to 50 MHz	____ Hz	____ dB	1 dB	73 dB
f2	50 M to 500 MHz	____ Hz	____ dB		73 dB
f3	500 M to 850 MHz	____ Hz	____ dB		73 dB
f4	950 MHz to 1.75 GHz	____ Hz	____ dB		(67-f) dB
f5	1.85 to 3.2 GHz	____ Hz	____ dB		(67-f) dB
f6	3.2 to 7.8 GHz	____ Hz	____ dB		(67-f) dB
f1*1	1.6 to 1.75 GHz	____ Hz	____ dB		67 dB
f2*1	1.85 to 7.8 GHz	____ Hz	____ dB		67 dB

Measurement range [Carrier Frequency: 850 MHz] (Low Power input, Pre-amplifier On)

	Measurement frequency range	Measurement frequency	Measured value (dB)	Measurement uncertainty	Effective lower limit
f1	100 k to 50 MHz	_____ Hz	_____ dB	1 dB	73 dB
f2	50 M to 500 MHz	_____ Hz	_____ dB		73 dB
f3	500 M to 800 MHz	_____ Hz	_____ dB		73 dB
f4	900 MHz to 1.65 GHz	_____ Hz	_____ dB		(67-f) dB
f5	1.75 to 2.5 GHz	_____ Hz	_____ dB		(67-f) dB
f6	2.6 to 3.2 GHz	_____ Hz	_____ dB		(67-f) dB
f7	3.2 to 7.8 GHz	_____ Hz	_____ dB		67 dB
f1*1	1.6 to 3.15 GHz	_____ Hz	_____ dB		67 dB

Measurement range [Carrier Frequency: 1800 MHz] (Low Power input, Pre-amplifier On)

	Measurement frequency range	Measurement frequency	Measured value (dB)	Measurement uncertainty	Effective lower limit
f1	100 k to 50 MHz	_____ Hz	_____ dB	1 dB	73 dB
f2	50 M to 500 MHz	_____ Hz	_____ dB		73 dB
f3	500 M to 850 MHz	_____ Hz	_____ dB		73 dB
f4	950 MHz to 1.75 GHz	_____ Hz	_____ dB		(67-f) dB
f5	1.85 to 3.2 GHz	_____ Hz	_____ dB		(67-f) dB
f6	3.2 to 7.8 GHz	_____ Hz	_____ dB		(67-f) dB
f1*1	1.6 to 1.75 GHz	_____ Hz	_____ dB		67 dB
f2*1	1.85 to 3.15 GHz	_____ Hz	_____ dB		67 dB

*1: When Option 03 is installed.

IQ Input Modulation Accuracy

Modulation measurement accuracy (IQ input)

Residual phase error (GMSK modulation)	Minimum value	0 deg. (rms)
	Actual measured value	_____deg. (rms)
	Maximum value	0.45 deg. (rms)
	Measurement uncertainty	0.05 deg. (rms)
Residual EVM (8PSK modulation)	Minimum value	0 %. (rms)
	Actual measured value	_____% (rms)
	Maximum value	0.45 % (rms)
	Measurement uncertainty	0.05 % (rms)

Power Meter Accuracy

Power meter reading (Set_Ref)

		50 MHz	2000 MHz	3000 MHz
SG set value (Set_Ref)	----	_____ dBm	_____ dBm	_____ dBm
Power meter reading (Read_Ref)	Upper limit		+10.1 dBm	
	Reading	_____ dBm	_____ dBm	_____ dBm
	Lower limit		–9.9 dBm	

ML2530A measured value when MN72A programmable attenuator ATT is varied (ATT_n)*1

ATT set value	ATT_n	50 MHz	2000 MHz	3000 MHz
10 dB	ATT_10	_____ dB	_____ dB	_____ dB
20 dB	ATT_20	_____ dB	_____ dB	_____ dB
30 dB	ATT_30	_____ dB	_____ dB	_____ dB

Measurement accuracy (Low Power input)

Frequency (MHz)	Input level (dBm)	SG & ATT set level	Tester measured value (dBm)	Measurement accuracy (%)*2	Effective range (dB)
50	+10	Set_Ref	_____ dBm	_____ dB	±5.8 %
	0	Set_Ref+ATT (10 dB)	_____ dBm	_____ dB	±5.8 %
	–10	Set_Ref+ATT (20 dB)	_____ dBm	_____ dB	±5.8 %
	–20	Set_Ref+ATT (30 dB)	_____ dBm	_____ dB	±5.8 %
2000	+10	Set_Ref	_____ dBm	_____ dB	±5.8 %
	0	Set_Ref+ATT (10 dB)	_____ dBm	_____ dB	±5.8 %
	–10	Set_Ref+ATT (20 dB)	_____ dBm	_____ dB	±5.8 %
	–20	Set_Ref+ATT (30 dB)	_____ dBm	_____ dB	±5.8 %
3000	+10	Set_Ref	_____ dBm	_____ dB	±5.8 %
	0	Set_Ref+ATT (10 dB)	_____ dBm	_____ dB	±5.8 %
	–10	Set_Ref+ATT (20 dB)	_____ dBm	_____ dB	±5.8 %
	–20	Set_Ref+ATT (30 dB)	_____ dBm	_____ dB	±5.8 %
Measurement uncertainty			±4.2 %		

*1: ATT_n is a minus value.

*2: Calculation method of measurement accuracy:

$$\text{Measurement accuracy [\%]} = \left\{ \frac{10^{(\text{Tester measured value}/10)}}{10^{(\text{Read\_Ref} + \text{ATT\_n})/10}} - 1 \right\} \times 100$$

MX860802A/MX860902A
GSM Measurement Software
(For MS8608A/MS8609A)
Operation Manual
(Remote Control)

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IV.

Section 1 General

This section outlines the remote control and gives examples of system upgrades.

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General

The MS8608A/MS8609A, when combined with an external controller (host computer, personal computer, etc.), can automate your measurement system. For this purpose, the MS8608A/MS8609A is equipped with an RS-232C interface port, and GPIB interface bus (IEEE std 488.2-1987) as standard compositions. Ethernet interface can be also installed as an option.

Remote control functions

The remote control functions of the MS8608A/MS8609A are used to do the following:

(1) Control all functions except a few like the power switch and [LOCAL] key

(2) Read all parameter settings.

(3) Set the RS-232C interface settings from the panel.

(4) Set the GPIB address from the panel.

(5) Set the IP address for Ethernet interface from the panel. (Optional)

(6) Select the interface port from the panel.

(7) Configure the automatic measurement system when the spectrum analyzer function is combined with a personal computer and other measuring instruments.

Interface port selection functions

The MS8608A/MS8609A Spectrum Analyzer function has the standard RS-232C interface, GPIB interface bus and parallel (Centronics) interface. It can also have Ethernet interface as an option. Use the panel to select the interface port to be used to connect external devices as shown below.

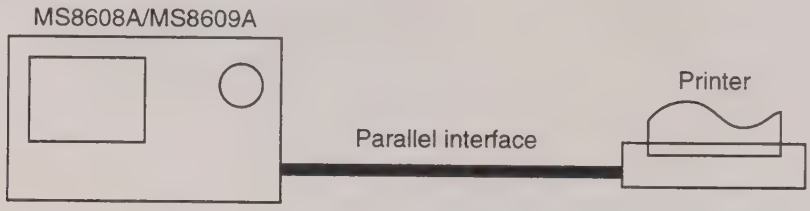
Port for the external controller: Select RS-232C, GPIB or Ethernet (Option).

Port for the printer: Parallel interface.

Examples of system upgrades using RS-232C and GPIB

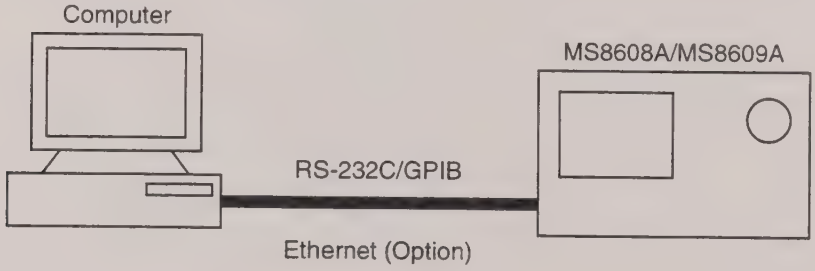
(1) Stand-alone type 1

Waveforms measured with MS8608A/MS8609A are output to the printer.



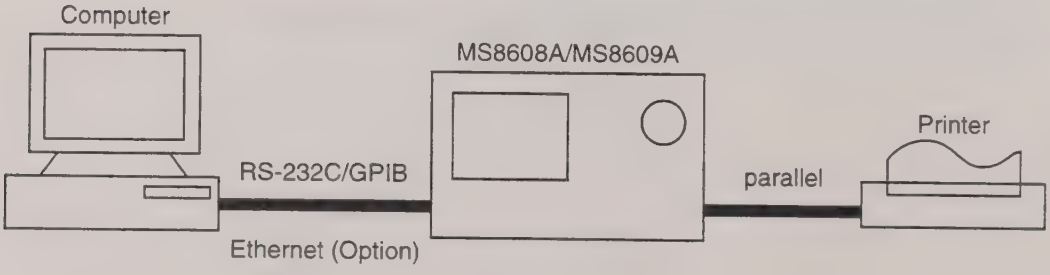
(2) Control by the host computer (1)

The spectrum analyzer is controlled automatically or remotely from the computer.



(3) Control by the host computer (2)

The waveforms measured by controlling spectrum analyzer automatically or remotely are output to the printer.



Specifications of RS-232C

The table below lists the specifications of the RS-232C provided as standard in MS8608A/MS8609A.

Item	Specification
Function	Control from the external controller (except for power-ON/OFF)
Communication system	Asynchronous (start-stop synchronous system), half-duplex
Communication control system	X-ON/OFF control
Baud rate	1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 k (bps)
Data bits	7 or 8 bits
Parity	Odd number (ODD), even number (EVEN), none (NON)
Start bit	1 bit
Stop bit (bits)	1 or 2 bits
Connector	D-sub 9-pin, male

Specifications of GPIB

The table below lists the specifications of the GPIB provided for MS8608A/MS8609A.

Item	Specification and supplementary explanation
Function	Conforms to IEEE488.2 The spectrum analyzer is controlled from the external controller (except for power-on/off).
Interface function (*1)	SH1: All source handshake functions are provided. Synchronizes the timing of data transmission. AH1: All acceptor handshake functions are provided. Synchronizes the timing of data reception. T6: The basic talker functions and serial poll function are provided. The talk only function is not provided. The talker can be canceled by MLA. L4: The basic listener functions are provided. The listenonly function is not provided. The listener can be canceled by MTA. SR1: All service request and status byte functions are provided. RL1: All remote/local functions are provided. The local lockout function is provided. PP0: The parallel poll functions are not provided. DC1: All device clear functions are provided. DT1: Device trigger functions are provided. C0: System controller functions are not provided. E2: Output is tri-state.

Section 2 Connecting Device

This section describes how to connect external devices such as the host computer, personal computer, and printer with RS-232C and GPIB cables. This section also describes how to setup the interfaces of the spectrum analyzer function.

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Connection Diagram of RS-232C Interface Signals 2-4
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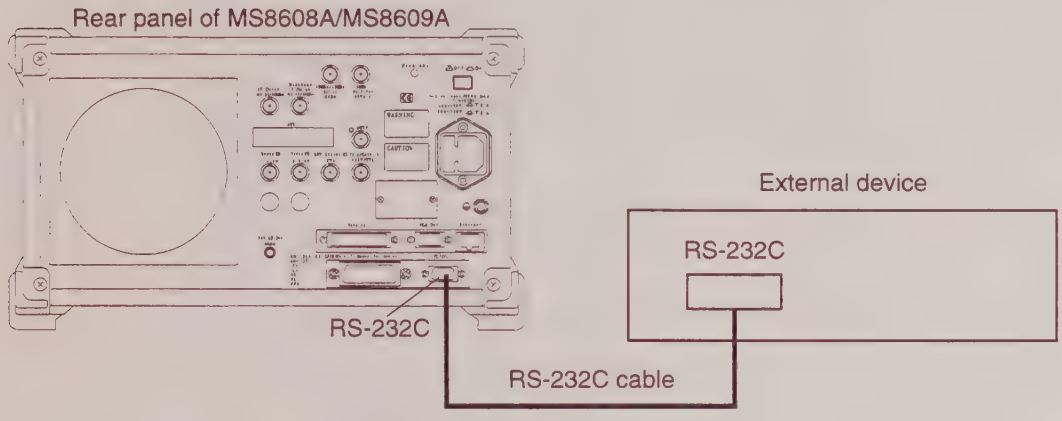
Setting the GPIB Address 2-6

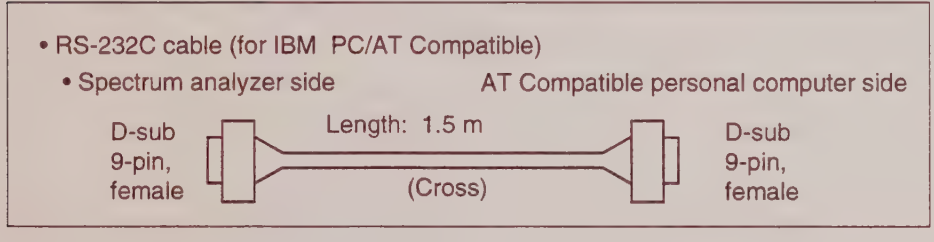
Connecting an External Device with an RS-232C Cable

Connect the RS-232C connector (D-sub 9-pin, female) on the rear panel of the spectrum analyzer to the RS-232C connector of the external device with an RS-232C cable.



Notes:

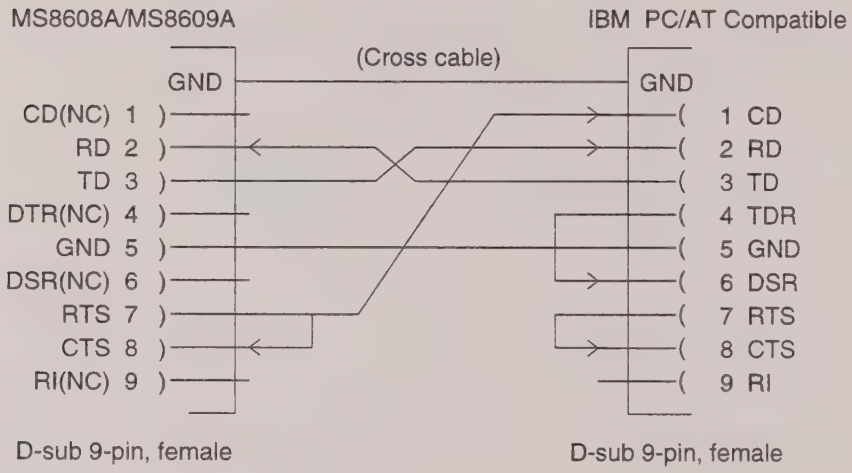
RS-232C connectors with 9 pins and 25 pins are available. When purchasing the RS-232C cable, check the number of pins on the RS-232C connector of the external device. Also, the following RS232C cable is provided as peripheral parts of the spectrum analyzer.



Connection Diagram of RS-232C Interface Signals

The diagram below shows the RS-232C interface signal connections between the spectrum analyzer and devices such as a personal computer.

- Connection with IBM PC/AT Compatible personal computer



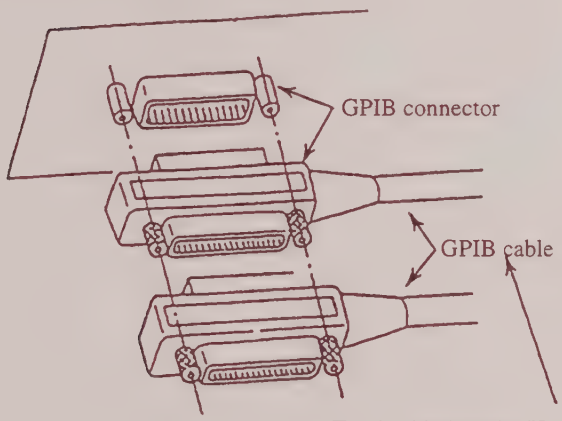
Connecting a Device with a GPIB Cable

Connect the GPIB connector on the rear panel of this equipment to the GPIB connector of an external device with a GPIB cable.

Note:

Be sure to connect the GPIB cable before turning the equipment power on.

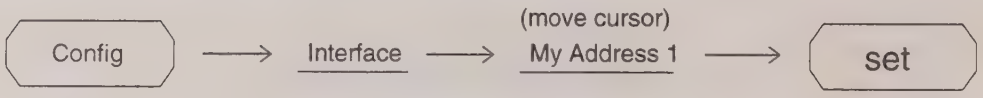
Up to 15 devices, including the controller, can be connected to one system. Connect devices as shown below.



Total cable length: Up to 20 m
Cable length between devices: Up to 4 m
Number of devices that can be connected: Up to 15

Setting the GPIB Address

Set the GPIB address of this equipment as follows.



Use the 10-key pad to enter the GPIB address of this equipment, next push (set) key to confirm address.
The initial value is 1.

Section 3 Device Message Format

This section describes the format of the device messages transmitted on the bus between a controller (host computer) and the device MS8608A/MS8609A via the RS-232C GPIB or Ethernet system.

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Program Message Format 3-3
Response Message Format 3-8

General Description

The device messages are data messages transmitted between the controller and devices, program messages transferred from the controller to this instrument (device), and response messages input from this instrument (device) to the controller. There are also two types of program commands and program queries in the program message. The program command is used to set this instrument's parameters and to instruct it to execute processing. The program query is used to query the values of parameters and measured results.

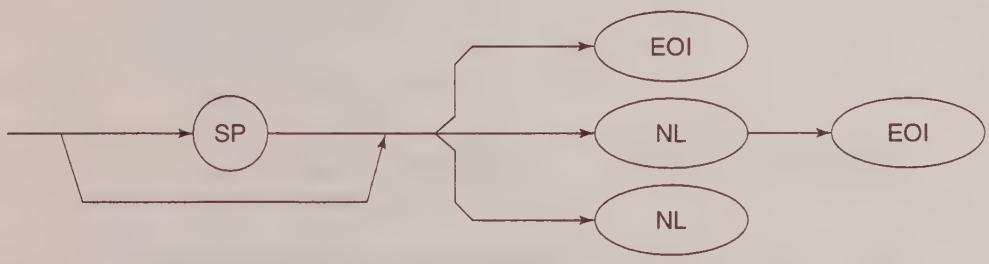
Program Message Format

To transfer a program message from the controller program to this instrument using the WRITE statement, the program message formats are defined as follows.

```
WRITE  #1,"CF :1GHZ"
```

PROGRAM MESSAGE: When the program message is transmitted from the controller to this instrument, the specified terminator is attached to the end of the program message to terminate its transmission.

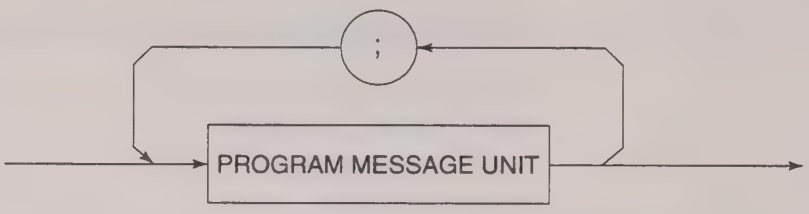
(1) PROGRAM MESSAGE TERMINATOR



NL: Called New line or LF (Line Feed)

Carriage Return (CR) is ignored and is not processed as a terminator.

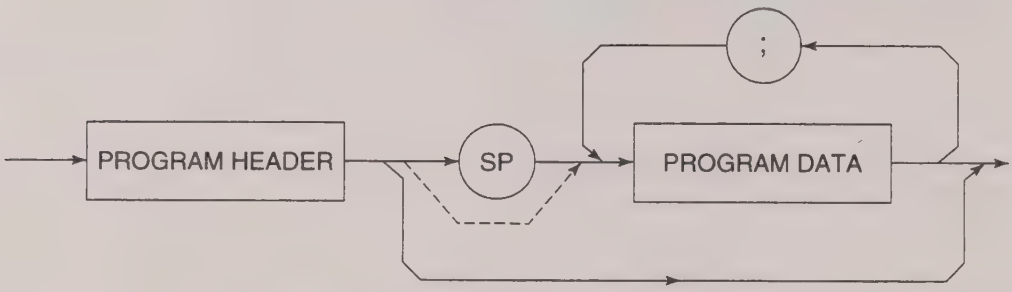
(2) PROGRAM MESSAGE



Multiple program message units can be output sequentially by separating them with a semicolon.

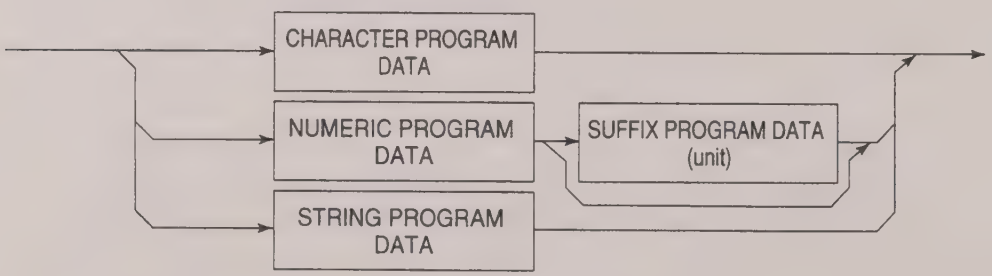
<Example> `WRITE #1;"CF 1GHZ;SP 5ØØKHZ`

(3) PROGRAM MESSAGE UNIT



- The program header of an IEEE488.2 common command always begins with an asterisk.
- For numeric program data, the (SP) between the header and data can be omitted.
- The program header of a program query always ends with a question mark.

(4) PROGRAM DATA



(5) CHARACTER PROGRAM DATA

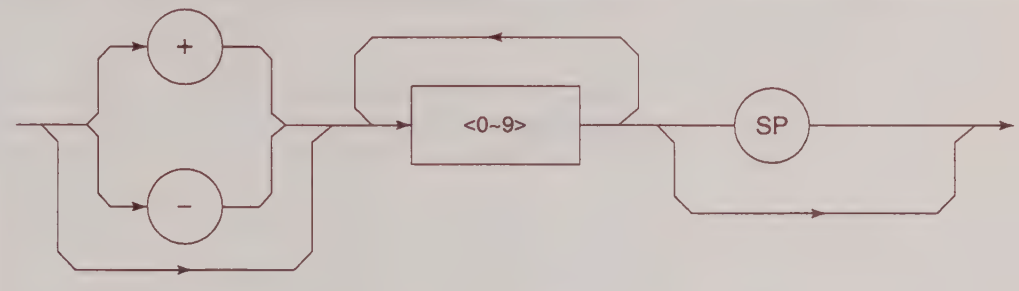
Character program data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

<Example> `WRITE #1;"ST AUTO"` ..... Sets Sweep Time to AUTO.

(6) NUMERIC PROGRAM DATA

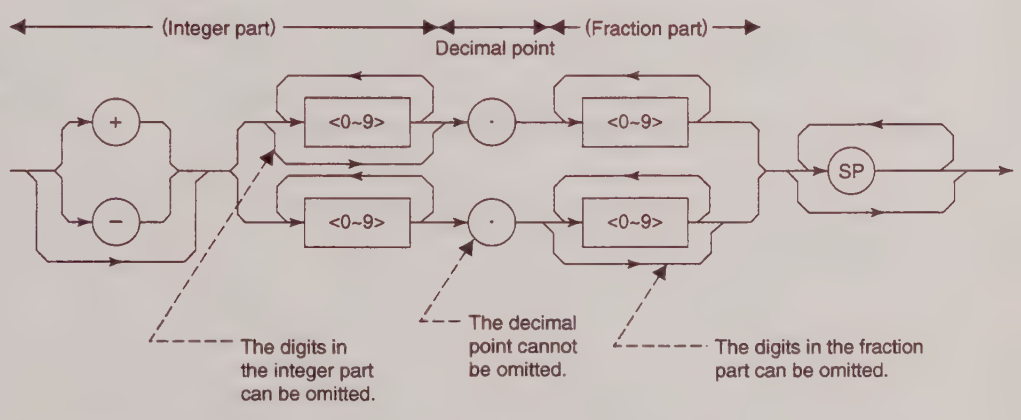
Numeric program data has two types of formats: integer format (NR1) and fixed-point format (NR2).

< Integer format (NR1) >



- Zeros can be inserted at the beginning → 005, +000045
- There must be no spaces between a + or - sign and a number → +5, + △5 (×)
- Spaces can be inserted after a number → +5△△△
- The + sign is optional → +5, 5
- Commas cannot be used to separate digits → 1,234,567 (×)

<Fixed-point format (NR2)>



- The numeric expression of the integer format applies to the integer part.
- There must be no spaces between numbers and the decimal point → +753△.123 (×)
- Spaces can be inserted after the digits in the fraction part → +753.123△△△
- A number need not be placed before the decimal point → .05
- A + or - sign can be placed before the decimal point → +.05, −.05
- A number can end with a decimal point → 12.

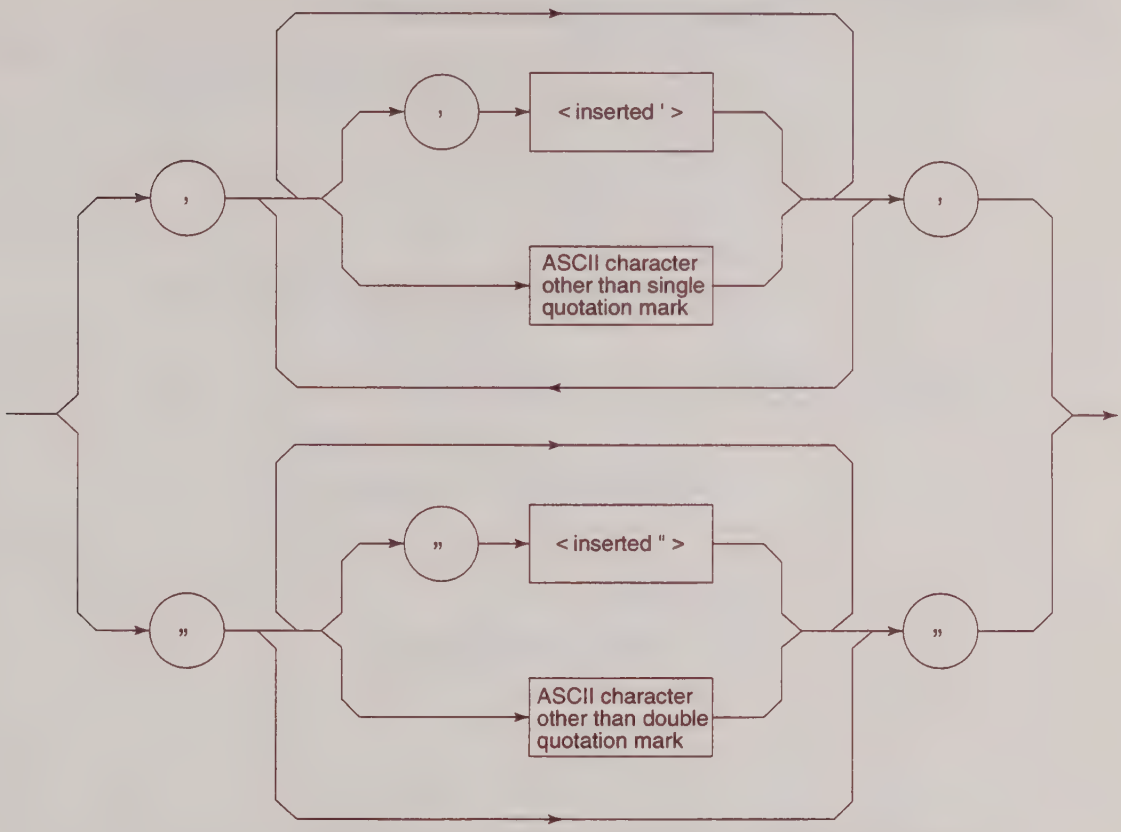
(7) SUFFIX PROGRAM DATA (unit)

The table below lists the suffixes used for MS8608A/MS8609A.

Table of Suffix Codes

Classification	Unit	Suffix code
Frequency	GHz	GHZ, GZ
	MHz	MHZ, MZ
	kHz	KHZ, KZ
	Hz	HZ
	Default	HZ
Time	second	S
	m second	MS
	μ second	US
	Default	MS
Level (dB system)	dB	DB
	dBm	DBM, DM
	dBμV	DBUV
	dBmV	DBMV
	dBμV(emf)	DBUVE
	Default	Determined in conformance with the set scale unit
Level (V system)	V	V
	mV	MV
	μV	UV
	Default	UV
Level (W system)	W	W
	mW	MW
	μW	UW
	nW	NW
	pW	PW
	fW	FW
	Default	UW

(8) STRING PROGRAM DATA



- String program data must be enclosed with single quotation marks ('...').

```
WRITE #1:"TITLE'MS8608A'"
```

A single quotation mark used within a character string must be repeated as shown in the double quotation marks.

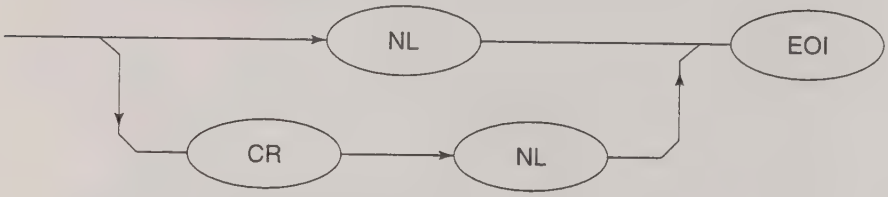
```
WRITE #1;"TITLE'MS8608A''NOISE MEAS'''"
```

MS8608A 'NOISE MEAS' is set as the title.

Response Message Format

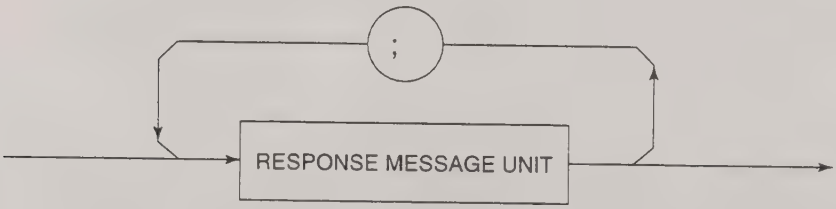
To transfer the response messages from this instrument to the controller using the READ statement, the response message formats are defined as follows.

(1) RESPONSE MESSAGE TERMINATOR



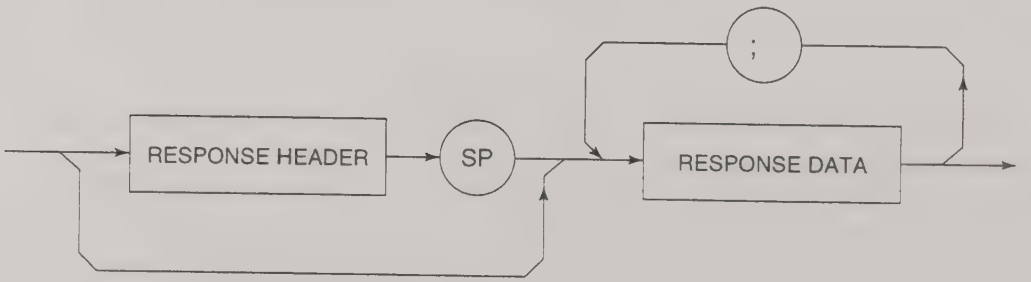
The response message terminator to be used depends on the TRM command specification.

(2) RESPONSE MESSAGE

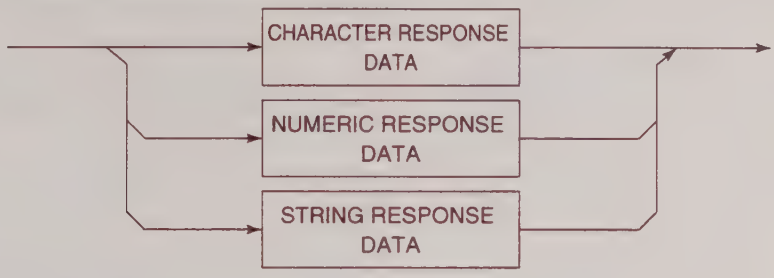


When a query is sent by the WRITE statement with one or more program queries, the response message also consists of one or more response message units.

(3) Usual RESPONSE MESSAGE UNIT



(4) RESPONSE DATA

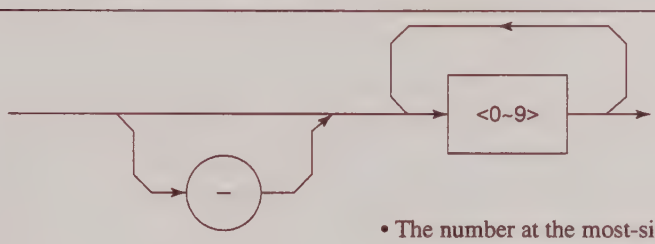


(5) CHARACTER RESPONSE DATA

Character response data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

(6) NUMERIC RESPONSE DATA

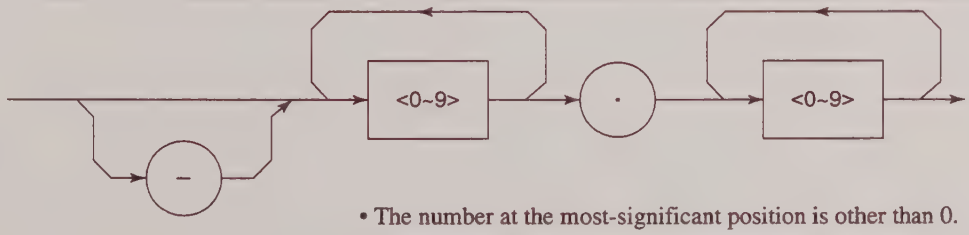
< Integer format (NR1) >



< Example >
123
-1234

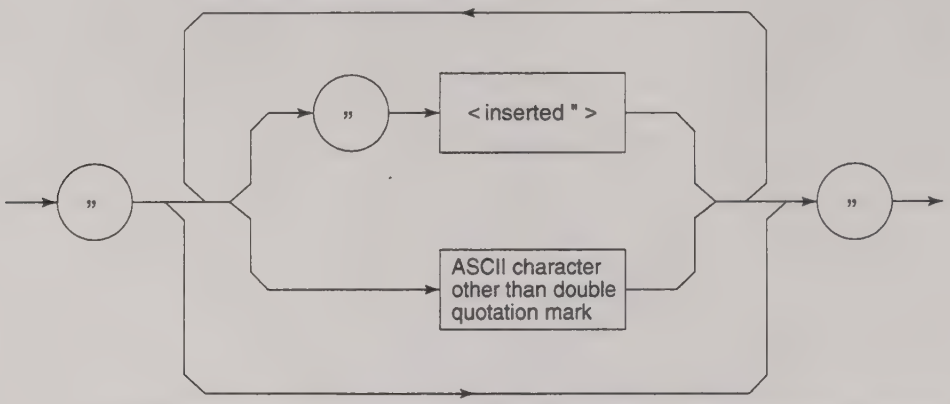
- The number at the most-significant position is other than 0.
- A + sign need not be placed before a positive number.

< Fixed-point format (NR2) >



- The number at the most-significant position is other than 0.
- A + sign need not be placed before a positive number.
- If there are zeros after the decimal point, the numeric data is transmitted in the integer format.

(7) CHARACTER RESPONSE DATA



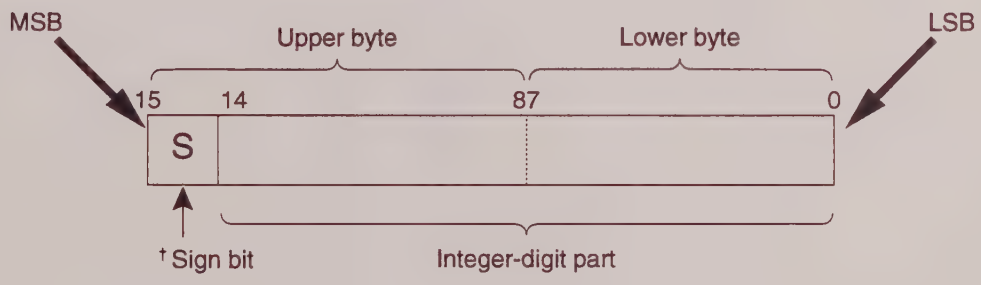
String response data is transmitted as an ASCII character enclosed with double quotation marks.

(8) Response message for input of waveform data using binary data

The waveform binary data is two-byte 65536 integer data from -32768 to 32767, as shown below; and sent in the sequence of upper byte and lower byte.

16-Bit Binary	With Sign	No Sign
1000000000000000	-32768	32768
1000000000000001	-32767	32769
1000000000000010	-32766	32770
1111111111111101	-3	65533
1111111111111110	-2	65534
1111111111111111	-1	65535
0000000000000000	0	0
0000000000000001	1	1
0000000000000010	2	2
0000000000000011	3	3
0111111111111101	32765	32765
0111111111111110	32766	32766
0111111111111111	32767	32767

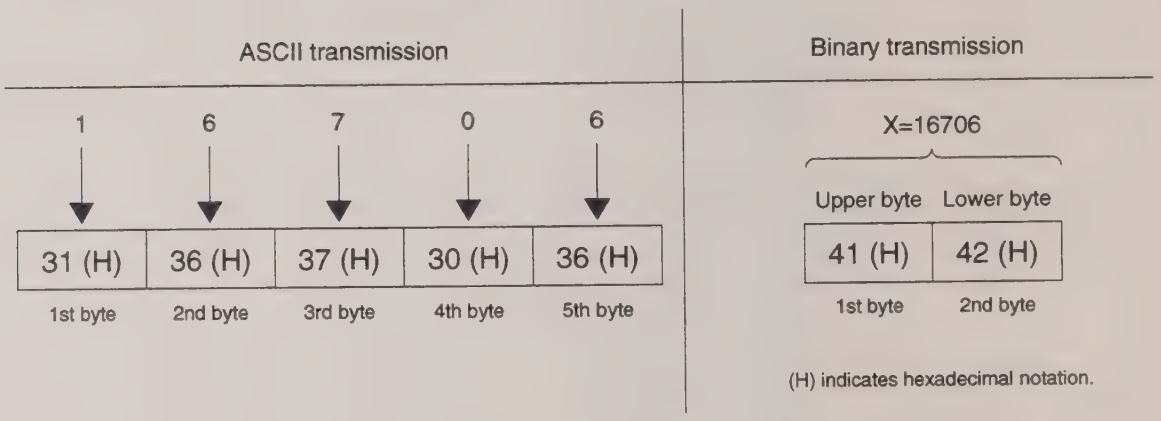
Sign bit: Bit 15(MSB) is used.
Integer-digit part: Bits 0 to 14 are used.
So, 16 bits(two bytes) are used.



Internal Representation of 2-byte Bynary Data

† When a negative number is stored in a numeric variable, the sign bit 1 is set in the MSB to indicate the negative value. The value is stored in a numeric variable in a 2's complement format.

For an example, to transmit an integer of 16706, the ASCII format is compared with the Binary format, below.
The ASCII format requires 5 bytes. Whereas, the Binary format requires only 2 bytes, and does not need the data format transformation. So, The Binary format is used for a high-speed transmission.



$$16706\ (D) = 4 \times 16^3 + 1 \times 16^2 + 4 \times 16^1 + 2 \times 16^0$$

Binary notation

	Upper byte								Lower byte							
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X=16706	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0

1st byte → 2nd byte (Transmission order)

bit	7	6	5	4	3	2	1	0	
1st byte	0	1	0	0	0	0	0	1	(Upper byte)= 41 (H)
2nd byte	0	1	0	0	0	0	1	0	(Lower byte)= 42 (H)

The waveform binary data has a number of bytes for
(Number of points to be specified) X 2 bytes + termination code.
Where, termination code is specified by the TRM command, and is LF(0D(H): 1 byte) or CR+LF(0A0D(H): 2 bytes).

Section 4 Status Structure

This section describes the device-status reporting and its data structure defined by the IEEE488.2 when the GPIB interface bus is used. This section also describes the synchronization techniques between a controller and device.

These functions are used to control a device from an external controller using the GPIB interface bus. Most of these functions can also be used to control a device from an external controller using the RS-232C or Ethernet interface

IEEE488.2 Standard Status Model 4-3
Status Byte (STB) Register 4-5
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Reading, writing, and clearing the Standard Event Status Register 4-10
Reading, writing, and clearing the Standard Event Status Enable Register 4-10
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Wait for a response after the *OPC? query is sent. .. 4-14
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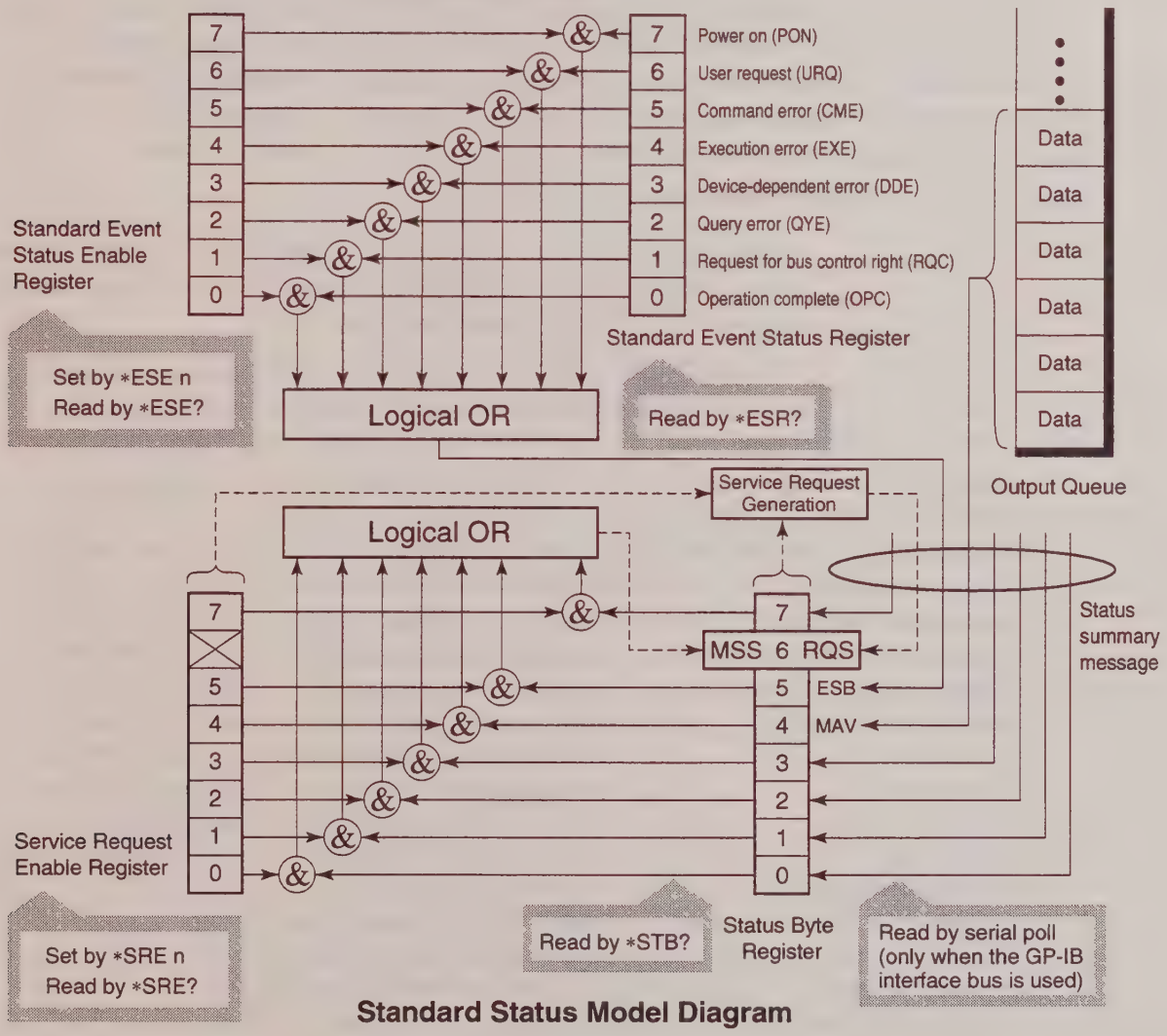
The Status Byte (STB) sent to the controller is based on the IEEE488.1 standard. The bits comprising the STB are called status summary messages because they represent a summary of the current data in registers and queues.

IEEE488.2 Standard Status Model

The diagram below shows the standard model for the status data structures stipulated in the IEEE488.2 standard.



Standard Status Model Diagram

In the status model, IEEE488.1 status bytes are used for the lowest grade status. This status byte is composed of seven summary message bits from the higher grade status structure. To create these summary message bits, the status data structure is composed of two types of register and queue models.

Register model	Queue model
The register model consists of two registers used for recording events and conditions encountered by a device. These two registers are the Event Status Register and Event Status Enable Register. When the results of the AND operation of both register contents are other than 0, the corresponding bit of the status bit becomes 1. In other cases, the corresponding bit becomes 0. When the result of their Logical OR is 1, the summary message bit also becomes 1. If the Logical OR result is 0, the summary message bit also becomes 0.	The queue in the queue model is used to sequentially record the waiting status values or information. If the queue is not empty, the queue structure summary message becomes 1. If the queue is empty, the message becomes 0.

In IEEE488.2, there are three standard models for the status data structure. Two are register models and one is a queue model based on the register model and queue model described above. The three standard models are:

[1] Standard Event Status Register and Standard Event Status Enable Register
[2] Status Byte Register and Service Request Enable Register Output Queue

Standard Event Status Register	Status Byte Register	Output Queue
The Standard Event Status Register has the same structure as the previously described register model. In this register, the bits for eight types of standard events encountered by a device are set as follows: [1] Power on [2] User request [3] Command error [4] Execution error [5] Device-dependent error [6] Query error [7] Request for bus control right [8] Operation complete The Logical OR output bit is represented by Status Byte Register bit 5 (DIO6) as a summary message for the Event Status Bit (ESB).	The Status Byte Register is a register in which the RQS bit and the seven summary message bits from the status data structure can be set. This register is used together with the Service Request Enable Register. When the results of the OR operation of both register contents are other than 0, SRQ becomes ON. To indicate this, bit 6 of the Status Byte Register (DIO7) is reserved by the system as the RQS bit. The RQS bit is used to indicate that there is a service request for the external controller. The mechanism of SRQ conforms to the IEEE488.1 standard.	The Output Queue has the structure of the queue model described above. Status Byte Register bit 4 (DIO5) is set as a summary message for Message Available (MAV) to indicate that there is data in the output buffer.

Status Byte (STB) Register

The STB register consists of the STB and RQS (or MSS) messages of the device.

ESB and MAV summary messages

This paragraph describes the ESB and MAV summary messages.

(1) ESB summary message

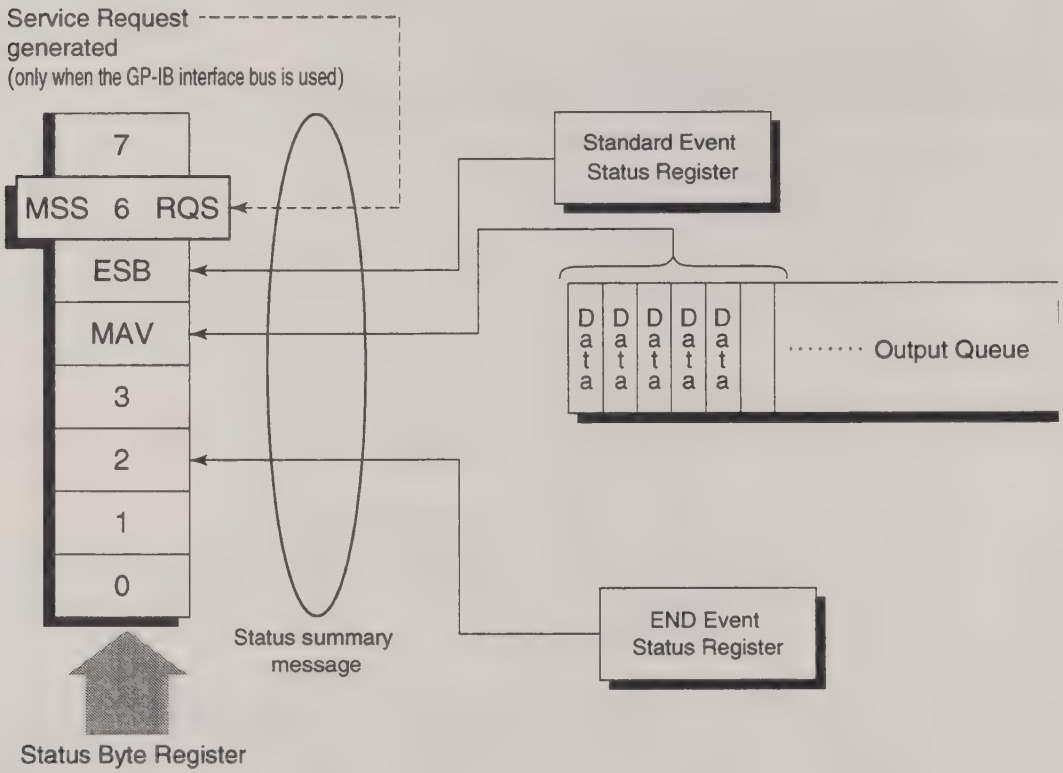
The ESB (Event Summary Bit) is a message defined by IEEE488.2 which uses bit 5 of the STB register. When the setting permits events to occur, the ESB summary message bit becomes 1 if any one of the events recorded in the Standard Status Register becomes 1. Conversely, the ESB summary message bit becomes 0 if one of the recorded events occurs, even if events are set to occur.
This bit becomes 0 when the ESR register is read by the *ESR? query or when it is cleared by the *CLS command.

(2) MAV summary message

The MAV (Message Available) summary bit is a message defined by IEEE488.2 which uses bit 4 of the STB register. This bit indicates whether the output queue is empty. The MAV summary message bit is
set to 1 when a device is ready to receive a request for a response message from the controller. When the output queue is empty, this bit is set to 0. This message is used to synchronize the information exchange with the controller. For example, this message is available when, after the controller sends a query command to a
device, the controller waits until MAV becomes 1. While the controller is waiting for a response from the device, other jobs can be processed. Reading the Output Queue without first checking MAV will cause all system bus operations to be delayed until the device responds.

Device-dependent summary messages

As shown in the diagram below, the spectrum analyzer does not use bits 0, 1, 3, and 7, and it uses bit 2 as the summary bit of the Event Status Register.



Reading and clearing the STB register

The STB register can be read using serial polling or the *STB? common query. The IEEE488.1 STB message can be read by either method, but the value sent to bit 6 (position) is different for each method.
The STB register contents can be cleared using the *CLS command.

(1) Reading by serial polling (only when the GPIB interface bus is used)

The IEEE488.1 serial polling allows the device to return a 7-bit status byte and an RQS message bit which conforms to IEEE488.1. The value of the status byte is not changed by serial polling. The device sets the RQS message to 0 immediately after being polled.

(2) Reading by the *STB? common query

The *STB? common query requires the devices to send the contents of the STB register and the integer format response messages, including the MSS (Master Summary Status) summary message. Therefore, except for bit 6, which represents the MSS summary message, the response to *STB? is identical to that of serial polling.

(3) Definition of MSS (Master Summary Message)

MSS indicates that there is at least one cause for a service request. The MSS message is represented at bit 6 response to an *STB? query, but it is not produced as a response to serial polling. It should not be taken as part of the status byte specified by IEEE488.1. MSS is configured by the overall logical OR in which the STB register and SRQ enable (SRE) register are combined.

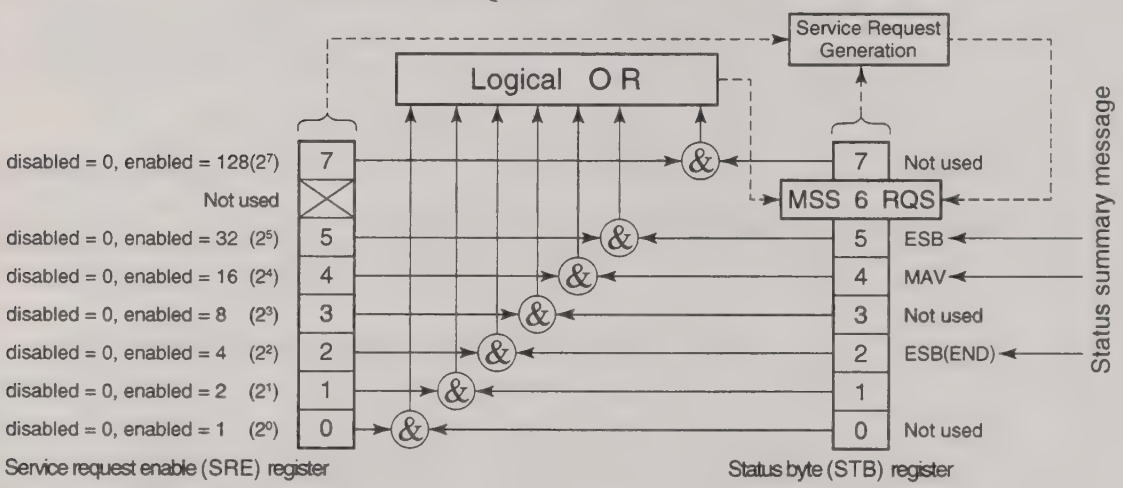
(4) Clearing the STB register using the *CLS common command

The *CLS common command clears all status data structures as well as the summary messages corresponding to them.
The *CLS command does not affect the settings in the Enable Register.

Service Request (SRQ) Enabling Operation

Bits 0 to 7 of the Service Request Enable Register (SRE) determine which bit of the corresponding STB register can generate SRQ.

The bits in the Service Request Enable Register correspond to the bits in the Status Byte Register. If a bit in the Status Byte Register corresponding to an enabled bit in the Service Request Enable Register is set to 1, the device makes a service request to the controller with the RQS bit set to 1.



(1) Reading the SRE register

The contents of the SRE register are read using the *SRE? common query. The response message to this query is an integer from 0 to 255 which is the sum of the bit digit weighted values in the SRE register.

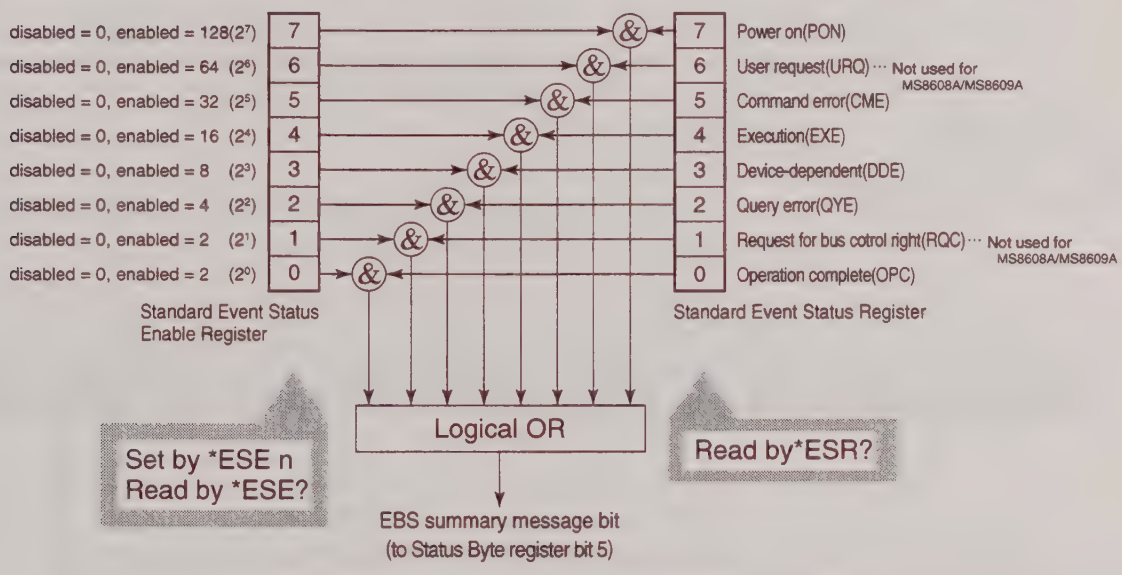
(2) Updating the SRE register

The SRE register is written using the *SRE common command. An integer from 0 to 255 is assigned as a parameter to set the SRE register bit to 0 or 1. The value of bit 6 is ignored.

Standard Event Status Register

Bit definition of Standard Event Status Register

The diagram below shows the operation of the Standard Event Status Register.



The Standard Event Status Enable (ESE) Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Power on (PON-Power on)	A transition from power-off to power-on occurred during the power-up procedure.
6	Not used	
5	Command error (CME-Command Error)	An illegal program message or a misspelled command was received.
4	Execution error (EXE-Execution Error)	A legal but unexecutable program message was received.
3	Device-dependent error (DDE-Device-dependent Error)	An error not caused by CME, EXE, or QYE occurred (parameter error, etc.).
2	Query error (QYE-Query Error)	An attempt was made to read data in the Output Queue when it was empty. Or, the data in the Output Queue was lost before it was read.
1	Not used	
0	Operation complete (OPC-Operation Complete)	This bit becomes 1 when this instrument has processed the *OPC command.

Reading, writing, and clearing the Standard Event Status Register

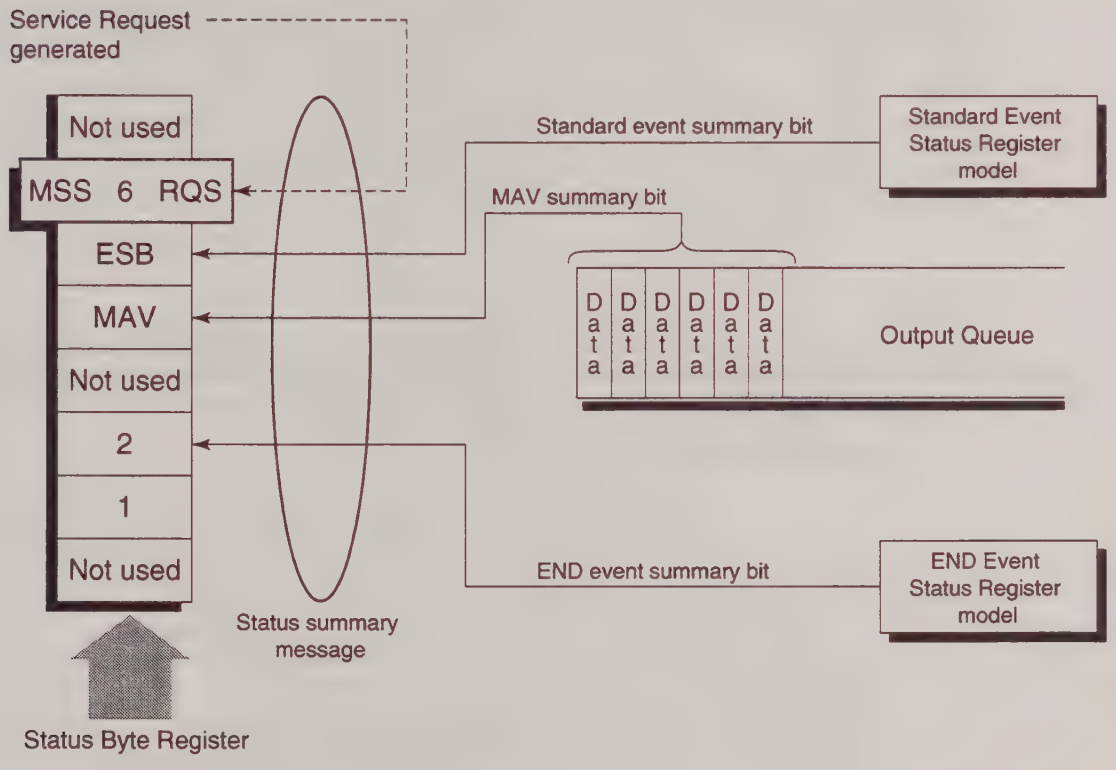
Reading	The register is read using the *ESR? command query. The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	With the exception of clearing, data cannot be written to the register from outside.
Clearing	The register is cleared when: [1] A *CLS command is received [2] The power is turned on Bit 7 is set to ON, and the other bits are cleared to 0 [3] An event is read for the *ESR? query command

Reading, writing, and clearing the Standard Event Status Enable Register

Reading	The registers is read using the *ESE? command. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	The register is written using the *ESE common command.
Clearing	The register is cleared when: [1] An *EXE command with a data value of 0 is received [2] The power is turned on The Standard Event Enable Register is not affected when: [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

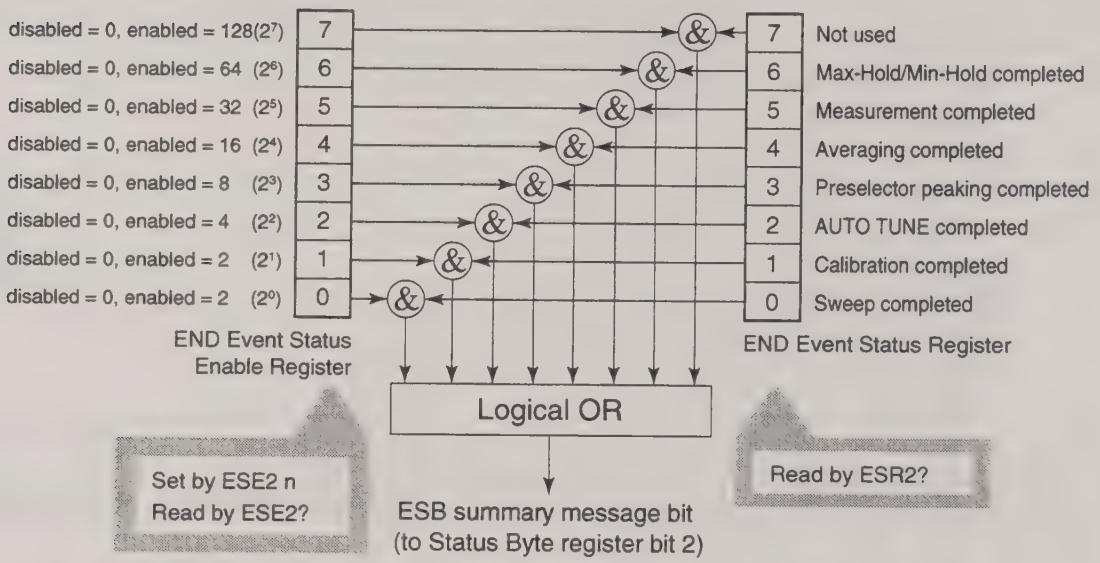
Extended Event Status Register

For MS8608A/MS8609A, bits 7, 3, 1, and 0 are unused. Bit 2 is assigned to the END summary bit as the status-summary bit supplied by the extended register model as shown below.



Bit definition of END Event Status Register

The diagram below shows the operation and event-bit names of the END Event Status Register.



The END Event Status Enable Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Not used	Not used
6	Max Hold/Min Hold	Sweeping according to the specified HOLD number has been completed.
5	Measurement completed	Calculation processing for measurements (frequency count, noise, etc.) has been completed.
4	Averaging completed	Sweeping according to the specified AVERAGE number has been completed.
3	Preselector peaking completed	Preselector peaking has been completed
2	AUTO TUNE completed	AUTO TUNE has been completed.
1	Calibration completed	ALL CAL, LEVEL CAL, or FREQ CAL has been completed.
0	Sweep completed	A single sweep has been completed or is in standby.

Reading, writing, and clearing the Extended Event Status Register

Reading	The ESR? common query is used to read the register. The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	With the exception of clearing, data cannot be written to the register from outside.
Clearing	The register is cleared when: [1] A *CLS command is received [2] The power is turned on [3] An event is read for the ESR2? query command

Reading, writing, and clearing the Extended Status Enable Register

Reading	The ESE2? query is used to read the register. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimals.
Writing	The ESE2 program command is used to write the register. Because bits 0 to 7 of the registers are weighted with values 1, 2, 4, 8, 16, 32, 64, and 128, respectively, the write data is transmitted as integer-format data that is the sum of the requiredbit digits selected from the weighted value.
Clearing	The register is cleared when: [1] An ESE2 program command with a data value of 0 is received [2] The power is turned on The Extended Event Status Enable register is not affected when: [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

Techniques for Synchronizing MS8608A/MS8609A with a Controller

MS8608A/MS8609A usually treats program messages as sequential commands that do not process newly-received commands until they complete the processing of the previous command. Therefore, no special consideration is necessary for pair-synchronization between MS8608A/MS8609A and the controller.

If the controller controls and synchronizes with one or more devices, after all the commands specified for MS8608A/MS8609A have been processed, the next commands must be sent to other devices.

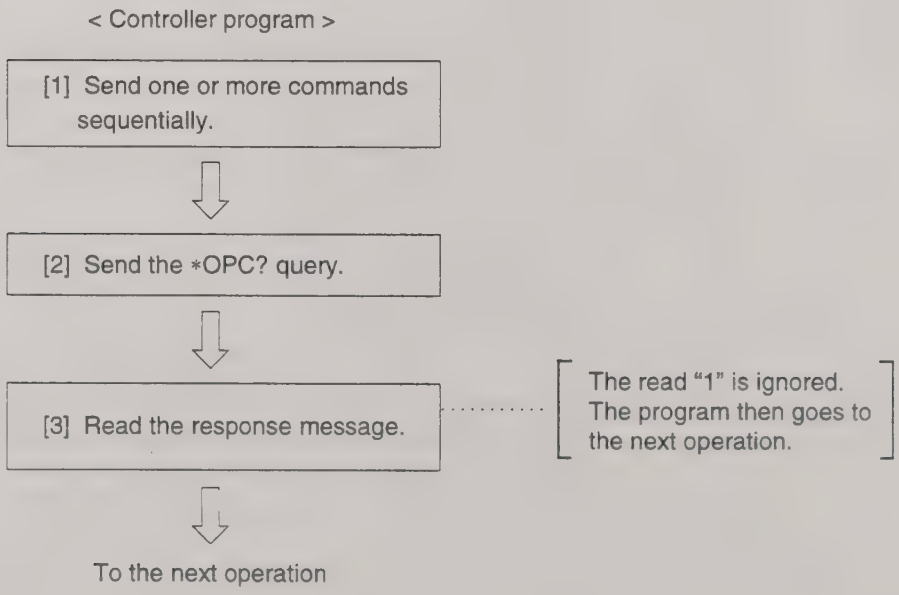
There are two ways of synchronizing MS8608A/MS8609A with the controller:

[1] Wait for a response after the *OPC? query is sent.

[2] Wait for SRQ after *OPC is sent.

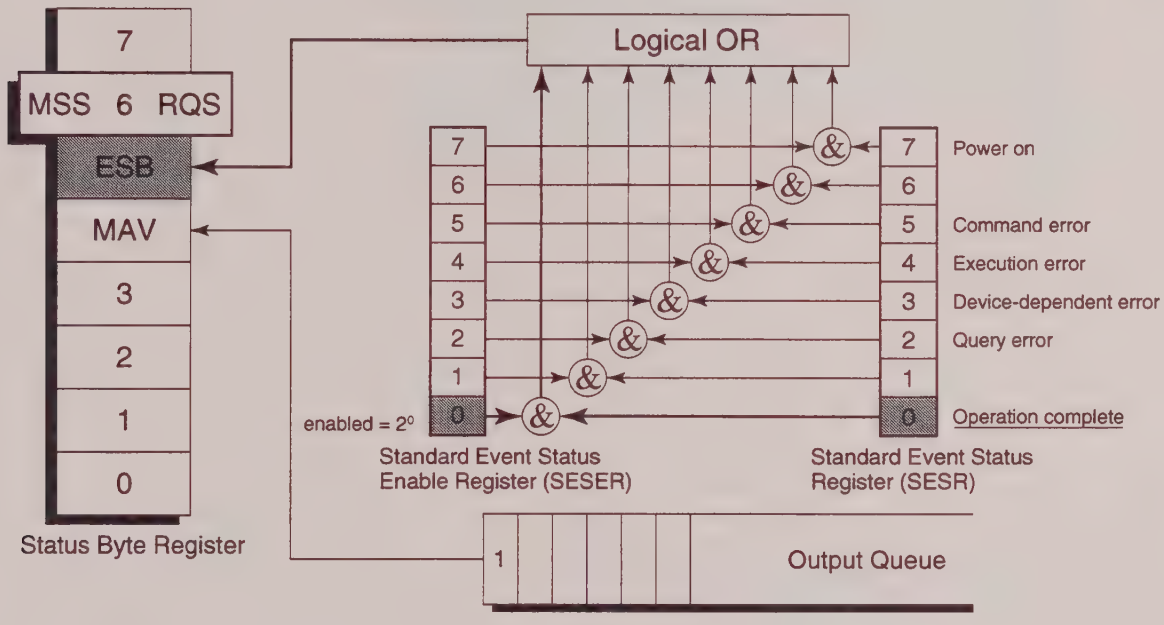
Wait for a response after the *OPC? query is sent.

MS8608A/MS8609A outputs "1" as the response message when executing the *OPC? query command. The controller is synchronized with MS8608A/MS8609A by waiting for the response message to be entered.



Wait for a service request after *OPC is sent (only when the GPIB interface bus is used).

The MS8608A/MS8609A sets the operation-complete bit (bit 0) to 1 when executing the *OPC command. The controller is synchronized with the spectrum analyzer for SRQ when the operation-complete bit is set for SRQ.



■ < Controller program >

[1] Enable the 2^0 bit of the Standard Event Status Enable Register. `PRINT @1;"*ESE 1"`

⇩

[2] Enable the 2^5 bit of the Service Request Enable Register. `PRINT @1;"*SRE 32"`

⇩

[3] Make the device execute the specified operation.

⇩

[4] Send the *OPC command. `PRINT @1;"*OPC"`

⇩

[5] Wait for the SRQ interrupt (ESB summary message). ····· Value of status byte: $2^6 + 2^5 = 96$

Section 5 Initial Settings

The MS8608A/MS8609A initializes the GPIB interface system at three levels in accordance with the IEEE488.2 specifications. This section describes how these three levels of initialization are processed, and how to instruct initialization from the controller.

Bus Initialization Using the IFC Statement 5-4
Initialization for Message Exchange by DCL and
SDC Bus Commands 5-5
Device Initialization Using the *RST Command 5-7
Device Initialization Using the INI/IP Command 5-8
Device Status at Power-on 5-8

In the IEEE488.2 standard, there are three levels of initialization. The first level is "bus initialization," the second level is "initialization for message exchange," and the third level is "device initialization." This standard also stipulates that a device must be set to a known state when the power is turned on.

Level	Initialization type	Description	Level combination and sequence
1	Bus initialization	The IFC message from the controller initializes all interface functions connected to the bus.	Level 1 can be combined with other levels, but must be executed before level 2.
2	Initialization for message exchange	Message exchanges of all devices and specified devices on the GP-IB are initialized using the SDC and DCL GP-IB bus commands, respectively. These commands also nullify the function that reports operation completion to the controller.	Level 2 can be combined with other levels, but must be executed before level 3.
3	Device initialization	The *RST or INI/IP command returns a specified device to a known device-specific state, regardless of the conditions under which it was being used.	Level 3 can be combined with other levels, but must be executed after levels 1 and 2.

When using the RS-232C (standard)/Ethernet (Option) interface port to control the MS8608A/MS8609A from the controller, the level-3 device initialization function of can be used, and the level-2 initialization function cannot be used. When using the GPIB (Standard) interface bus to control the MS8608A/MS8609A from the controller, the initialization functions of levels 1, 2, and 3 can be used.

The following paragraph describes the commands for initialization at levels 1, 2, and 3 and the items that are initialized. This paragraph also describes the known state which is set when the power is turned on.

Bus Initialization Using the IFC Statement

■ Example

```
board% = 0
CALL SendIFC (board%)
```

■ Explanation

This function can be using when using the GPIB interface bus is used to control the spectrum analyzer function from the controller.
The IFC statement initializes the interface functions of all devices connected to the GPIB bus line.
The initialization of interface functions involves clearing the interface function states of devices set by the controller, and resetting them to their initial states. In the table below, indicates the functions which are initialized, and indicates the functions which are partially initialized.

No	Function	Symbol	Initialization by IFC
1	Source handshake	SH	○
2	Acceptor handshake	AH	○
3	Talker or extended talker	T or TE	○
4	Listener or extended listener	L or LT	○
5	Service request	SR	△
6	Remote/local	RL	
7	Parallel poll	PP	
8	Device clear	DC	
9	Device trigger	DT	
10	Controller	C	○

Bus initialization by the IFC statement does not affect the device operating state (frequency settings, LED on/off, etc.).

Initialization for Message Exchange by DCL and SDC Bus Commands

■ Example

Initializes all devices on the bus for message exchange (sending DCL).

```
board% = 0
addresslist% = NOADDR
CALL DevClearList(board%, addresslist%)
```

Initializes only the device at address 3 for message exchange (sending SDC).

```
board% = 0
address% = 3
CALL DevClear(board%, address%)
```

■ Explanation

This function can be used when the GPIB interface is used to control the spectrum analyzer function from the controller.
This statement executes initialization for message exchange of all devices or a specified device on the GPIB having the specified select code.

■ Items to be initialized for message exchange

When the spectrum analyzer accepts the DCL or SDC bus command, it does the following:

[1] Input buffer and Output Queue:	Clears them and also clears the MAV bit.
[2] Parser, Execution Controller, and Response Formatter:	Resets them.
[3] Device commands including *RST:	Clears all commands that prevent these commands from being executed.
[4] Processing of the *OPC? command:	Puts a device in OCIS (Operation Complete Command Idle State). As a result, the operation complete bit cannot be set in the Standard Event Status Register.
[5] Processing of the *OPC? query:	Puts a device in OQIS (Operation Complete Query Idle State). As a result, the operation complete bit 1 cannot be set in the Output Queue.
[6] Device functions:	Puts all functions associated with message exchange in the idle state. The device continues to wait for a message from the controller.

CAUTION ⚠

The following are not affected even if the DCL and SDC commands are processed.

[1] Current data set or stored in the device
[2] Front panel settings
[3] Status of status byte other than MAV bit
[4] A device operation in progress

Device Initialization Using the *RST Command

■ Syntax

*RST

■ Example

For RS-232C/Ethernet

```
WRITE #1,"*RST"
```
..... Initializes the spectrum analyzer function at address 1 at level 3.

For GPIB

```
SPA%=1
CALL Send(0,SPA,"*RST",NLend)
```

■ Explanation

The *RST (Reset) command is an IEEE488.2 common command that resets a device at level 3.
The *RST (Reset) command is used to reset a device (spectrum analyzer function) to a specific initial state.

Note:

The *RST command does not affect the following.

[1] IEEE488.1 interface state
[2] Device address
[3] Output Queue
[4] Service Request Enable register
[5] Standard Event Status Enable register
[6] Power-on-status-clear flag setting
[7] Calibration data affecting device specifications
[8] Parameters preset for control of external device, etc.

☞ For details of the settings of the spectrum analyzer after initialization, see Appendix A.

Device Initialization Using the INI/IP Command

■ Syntax

```
INI
IP
```

■ Example (program message)

For RS-232C/Ethernet

```
WRITE #1,"INI"
```
..... Initializes the device (spectrum analyzer function) at address 1 at level 3.

For GPIB

```
SPA%=1
CALL Send(0,SPA%,"INI",NLend)
```

■ Explanation

The INI and IP commands are the spectrum analyzer device-dependent messages that initialize a device at level 3.

Device Status at Power-on

When the power is turned on:

[1] The device is set to the status it was in at power-off.
[2] The Input Buffer and Output Queue are cleared.
[3] The Parser, Execution Controller, and Response Formatter are initialized.
[4] The device is put into OCIS (Operation Complete Command Idle State).
[5] The device is put into OQIS (Operation Complete Query Idle State).
[6] The Standard Event Status and Standard Event Status Enable Registers are cleared. Events can be recorded after the registers have been cleared.

As the special case of [1], when the spectrum analyzer is powered on for the first time after delivery, the spectrum analyzer settings are those listed in the Initial Settings Table(☞ Appendix A).

Section 6 Device Message List

This section describes the device message list of the MX860802A/MX860902A GSM Measurement Software as the table of contents, below.
For the details of these messages, see Section 7 Command Details.

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How To Read the Device Message List

- Program message and Query message

  (a) Upper-case letters: Reserved word

  (b) Numeric values: Reserved word (Numeric value code)

  (c) Lower-case letters in argument

Argument	Meaning	Type	Unit/Suffix code
f	frequency	Real number with decimal point or integer	GHZ, MHZ, KHZ, HZ, GZ, MZ, KZ, None (HZ)
t	time	Real number with decimal point or integer	S, SC, MS, US, None (MS)
l	level	Real number with decimal point or integer	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW, UW, NW, None (Fixed unit)
n	Non-unit integer or unit-specified integer	Decimal integer	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real num ber or unit-specified real number	Real number	None or specified

- Response message

  (a) Upper-case letters: Reserved word

  (b) Numeric values: Reserved word (Numeric value code)

  (c) Lower-case letters in argument

Argument	Meaning (Unit)	Type	Unit
f	frequency	Real number with decimal point or integer	Hz
t	time	Real number with decimal point or integer	ms
l	level	Real number with decimal point or integer	Fixed or specified
n	Non-unit integer or unit-specified integer	Decimal integer, number of digits can be changed. (Integers in effective digits are output.)	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real number or unit-specified real number	Real number with decimal point, number of digits can be changed. (Real numbers in effective digits are output.)	None or specified
j	Value judgment	PASS (Unit specification) or FAIL (Out of specification)	None
u	Specified unit	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW, UW, NW	None

Common to All Screens

Function	Item		Program Message	Query Message	Response Message	Remarks
Initialization						
Preset			PRE	---	---	
			INI	---	---	
			IP	---	---	
Switching Screen Layer						
Setup Common Parameter			DSPL SETCOM	DSPL?	SETCOM	
Modulation Analysis			DSPL MODANAL	DSPL?	MODANAL	
RF Power	RF Power		DSPL RFPWR	DSPL?	RFPWR	
	Seup Template		DSPL SETTEMP_RFPWR	DSPL?	SETTEMP_RFPWR	
			DSPL SETTEMP	DSPL?	SETTEMP	
Output RF Spectrum	High Speed		DSPL ADJ,HIGH	DSPL?	ADJ,HIGH	
Spurious Emission	Spot		DSPL SPURIOUS,SPOT	DSPL?	SPURIOUS,SPOT	
	Search		DSPL SPURIOUS,SEARCH	DSPL?	SPURIOUS,SEARCH	
	Sweep		DSPL SPURIOUS,SWEEP	DSPL?	SPURIOUS,SWEEP	
	Setup Frequency Table	Spot	DSPL SETTBL_SPU,SPOT	DSPL?	SETTBL_SPU,SPOT	
		Search & Sweep	DSPL SETTBL_SPU,SWEEP	DSPL?	SETTBL_SPU,SWEEP	
Power Meter			DSPL PWRMTR	DSPL?	PWRMTR	
IQ Level			DSPL IQLVL	DSPL?	IQLVL	
Back Screen			BS	---	---	
Starting Measurement						
Sweep/Measure	Single	No Sync	SNGLS	---	---	
			S2	---	---	
		Sync	SWP	---	---	
			TS	---	---	
	Continous		CONTS	---	---	
			S1	---	---	
Sweep/Measure Status	Measure/Sweep End		---	SWP?	SWP 0	
	During Measure/Sweep		---	SWP?	SWP 1	

Function	Item			Program Message	Query Message	Response Message	Remarks
Switch Screen and Measure Start	Setup Common Parameter			MEAS SETCOM	MEAS?	SETCOM	
	Modulation Analysis			MEAS MODANAL	MEAS?	MODANAL	
	RF Power	RF Power		MEAS RFPWR	MEAS?	RFPWR	
		Setup Template		MEAS SETTEMP_RFPWR	MEAS?	SETTEMP_RFPWR	
				MEAS SETTEMP	MEAS?	SETTEMP	
	Output RF Spectrum	High Speed		MEAS ADJ,HIGH	MEAS?	ADJ,HIGH	
	Spurious Emission	Spot		MEAS SPURIOUS,SPOT	MEAS?	SPURIOUS,SPOT	
		Search		MEAS SPURIOUS,SEARCH	MEAS?	SPURIOUS,SEARCH	
		Sweep		MEAS SPURIOUS,SWEEP	MEAS?	SPURIOUS,SWEEP	
		Setup Freq -uency Table	Spot	MEAS	MEAS? SETTBL_SPU,SPOT	SETTBL_SPU,SPOT	
			Search & Sweep	MEAS SETTBL_SPU, SWEEP	MEAS?	SETTBL_SPU,SWEEP	
	Power Meter			MEAS PWRMTR	MEAS?	PWRMTR	
	IQ Level			MEAS IQLVL	MEAS?	IQLVL	
Switching RF Signal Input Connectors							
Switch RF Input Connector	High			RFINPUT HIGH	RFINPUT?	HIGH	Effective only for MS8608A
	Low			RFINPUT LOW	RFINPUT?	LOW	Effective only for MS8608A
Pre-amplifier							
Pre Ampl	On			PREAMP ON	PREAMP?	ON	Effective only when the pre-amplifier option is installed
	Off			PREAMP OFF	PREAMP?	OFF	Effective only when the pre-amplifier option is installed
Correcting Level							
Correction	Off			CORR 0	CORR?	0	
	Table1			CORR 1	CORR?	1	
	Table2			CORR 2	CORR?	2	
	Table3			CORR 3	CORR?	3	
	Table4			CORR 4	CORR?	4	
	Table5			CORR 5	CORR?	5	

Setup Common Parameter

Function	Item	Program Message	Query Message	Response Message	Remarks
Input					
Terminal	RF	TERM RF	TERM?	RF	
	IQ-DC	TERM IQDC	TERM?	IQDC	
	IQ-AC	TERM IQAC	TERM?	IQAC	
	IQ-Balance	TERM IQBAL	TERM?	IQBAL	
Impedance	50 Ω	IQINZ 50	IQINZ?	50	
	1M Ω	IQINZ 1M	IQINZ?	1M	
Reference Level		RFLVL l	RFLVL?	l	l: <High> (–10.00+offset) dBm to (42.00+offset) dBm <Low> (–30.00 dBm+offset) to (22.00 dBm+offset) The ranges above are for the case of the MS8608A when the pre-amplifier is off. For MS8609A, the setting range for the Low Power input can be set.
Reference Level Offset		RFLVLOFS l	RFLVLOFS?	l	l : –99.99 dB to 99.99 dB
Frequency					
Channel		CHAN n	CHAN?	n	n: 0 to 20000
Frequency		FREQ f	FREQ?	f	f: 100 Hz to 7.8 GHz (For MS8608A) f: 100 Hz to 13.2 GHz (For MS8609A)
Channel & Frequency		CHFREQ n,f	---	---	n: 1 to 20000 f: 100 Hz to 7.8 GHz (For MS8608A) f: 100 Hz to 13.2 GHz (For MS8609A)
Channel Spacing		CHSPC f	CHSPC?	f	f: 0 Hz to 7.8 GHz
Signal					
Modulation Type	GMSK	MODTYPE GMSK	MODTYPE?	GMSK	
	8-PSK	MODTYPE 8PSK	MODTYPE?	8PSK	
Measuring Object	Normal Burst	MEASOBJ NB	MEASOBJ?	NB	
	Access Burst	MEASOBJ AB	MEASOBJ?	AB	
	Synchronization Burst	MEASOBJ SB	MEASOBJ?	SB	
	Continuous	MEASOBJ	CONTMEASOBJ?	CONT	

Function	Item	Program Message	Query Message	Response Message	Remarks
Training Sequence					
Pattern	TSC0	PATT TSC0	PATT?	TSC0	
	TSC1	PATT TSC1	PATT?	TSC1	
	TSC2	PATT TSC2	PATT?	TSC2	
	TSC3	PATT TSC3	PATT?	TSC3	
	TSC4	PATT TSC4	PATT?	TSC4	
	TSC5	PATT TSC5	PATT?	TSC5	
	TSC6	PATT TSC6	PATT?	TSC6	
	TSC7	PATT TSC7	PATT?	TSC7	
	ETSC	PATT ETSC	PATT?	ETSC	
	SYNCH	PATT SYNCH	PATT?	SYNCH	
	NO	PATT NO	PATT?	NO	
	USER	PATT USER	PATT?	USER	
User Pattern Length		PATT_ULEN	PATT_ULEN?	n	n: (GMSK) 1symbol to 64symbol (8-PSK) 1symbol to 26symbol
User Bit Pattern	GMSK	PATT_UBIT h	PATT_UBIT?	h	h: 0 to FFFFFFFFFFFFFFFF
	8-PSK	PATT_UBIT o	PATT_UBIT?	o	o: 0 to 77777777777777777777777
Start Point		PATT_USTA	RTPATT_USTART?	n	n: <<GMSK>> <NB,SB> 0symbol to (147 - User Pattern Length) symbol <AB> 0symbol to (87 - User Pattern Length) symbol <<8-PSK>> 0symbol to (147 - User Pattern Length) symbol
Tigger					
Tirgger	Free Run	TRG FREE	TRG?	FREE	
	External	TRG EXT	TRG?	EXT	
Trigger Edge	Rise	TRGEDGE RISE	TRGEDGE?	RISE	
	Fall	TRGEDGE FALL	TRGEDGE?	FALL	
Trigger Delay		TRGDLY t	TRGDLY?	t	t: –120.000 ms to 120.000 ms
Trigger Timeout (Remote Only)		TRGWAIT n	TRGWAIT?	n	n: 0s to 2147483647 s
Symbol align offset (Remote Only)					
Symbol align offset	Normal	SYMOFS NRM	SYMOFS?	NRM	
	Half	SYMOFS HALF	SYMOFS?	HALF	

Modulation Analysis

Function	Item	Program Message	Query Message	Response Message	Remarks
Trace Format					
Trace Format	None	TRFORM NON	TRFORM?	NON	
	Trellis	TRFORM TRLIS	TRFORM?	TRLIS	
	Constellation	TRFORM CONS	TELTRFORM?	CONSTEL	
	EVM	TRFORM VECT	TRFORM?	VECT	
	Eye Diagram	TRFORM EYE	TRFORM?	EYE	
	Phase Error	TRFORM PHASE	TRFORM?	PHASE	
	Magnitude Error	TRFORM MAGTD	TRFORM?	MAGTD	
Storage Mode					
Storage Mode	Normal	STRG_MOD NRM	STRG_MOD?	NRM	
	Average	STRG_MOD AVG	STRG_MOD?	AVG	
	Overwrite	STRG_MOD OVER	STRG_MOD?	OVER	
Average Count		AVR_MOD n	AVR_MOD?	n	n: 2 to 9999
Refresh Interval	Every	INTVAL_MOD EVERY	INTVAL_MOD?	EVERY	
	Once	INTVAL_MOD ONCE	INTVAL_MOD?	ONCE	
Filter					
Filter	Non	FILTER NON	FILTER?	NON	
	Nyquist	FILTER NYQST	FILTER?	NYQST	
	Nyquist & Inverse	FILTER NYQSTINVS	FILTER?	NYQSTINVS	
	Specification	FILTER SPEC	FILTER?	SPEC	
Scale Mode					
Interpolation (Constellation)	Non	INTPOL NON	INTPOL?	NON	
	Linear	INTPOL LIN	INTPOL?	LIN	
	10points	INTPOL POINT10	INTPOL?	POINT10	
	Linear & Symbol Position	INTPOL LINSYM	INTPOL?	LINSYM	
	10points & Symbol Position	INTPOL P10SYM	INTPOL?	P10SYM	
Vertical Scale (EVM, Phase Error, Magnitude Error)	5 % or 5 deg	VSCALE 5	VSCALE?	5	
	10 % or 10 deg	VSCALE 10	VSCALE?	10	
	20 % or 20 deg	VSCALE 20	VSCALE?	20	
	50 % or 50 deg	VSCALE 50	VSCALE?	50	
	100 % or 100 deg	VSCALE 100	VSCALE?	100	

Function	Item	Program Message	Query Message	Response Message	Remarks
Marker					
Marker Mode	Normal	MKR_MOD NRM	MKR_MOD?	NRM	
	Off	MKR_MOD OFF	MKR_MOD?	OFF	
Marker Position	Trellis, Constellation, EVM, Eye Diagram, Phase Error, Magnitude Error	MKP_MOD r	MKP_MOD?	r	r: 0.0symbol to 147.0symbol (GMSK) 3.0symbol to 144.0symbol (8-PSK)
Marker Level	Trellis, EVM, Phase Error, Magnitude Error	---	MKL_MOD?	r	
	I (Constellation, Eye Diagram)	---	MKL_MOD? I	r	
	Q (Constellation, Eye Diagram)	---	MKL_MOD? Q	r	
Calibration					
Adjust Range		ADJRNG	---	---	
Power Calibration		PWRCAL	PWRCAL?	l	l: –10.00 dB to 10.00 dB
Calibration Cancel		CALCANCEL	---	---	
Calibration Value		CALVAL l	CALVAL?	n, l	n: mode (0: Not calibrated, 1: Internal calibration, 2: Externally input calibration) l: –10.00 to 10.00 dB
Measure Result					
Carrier Frequency		---	CARRF?	f	
Carrier Frequency Error	Hz	---	CARRFERR?	f	
		---	CARRFERR? HZ	f	
	ppm	---	CARRFERR? PPM	r	unit: ppm
RMS Phase Error		---	PHASEERR?	r	unit: deg
Peak Phase Error		---	PPHASEERR?	r	unit: deg
	+	---	PPHASEERR? +	r	unit: deg
	–	---	PPHASEERR? –	r	unit: deg
Peak Phase Error Symbol		---	PPHASESYM?	r	
	+	---	PPHASESYM? +	r	
	–	---	PPHASESYM? –	r	
RMS Magnitude Error		---	MAGTDERR?	r	unit: %
Peak Magnitude Error	+	---	PMAGTDERR? +	r	unit: %
	–	---	PMAGTDERR? –	r	unit: %

Function	Item	Program Message	Query Message	Response Message	Remarks
Peak Magnitude	+	---	PMAGTDSYM? +	r	
Error Symbol	–	---	PMAGTDSYM? –	r	
RMS EVM		---	VECTERR?	r	unit: %
Peak EVM		---	PVECTERR?	r	unit: %
Origin Offset		---	ORGNOFS?	l	
95:th percentile EVM		---	EVM95PCT?	r	unit: %
Wave Data / Data Modify	I Data (Constellation, Eye Diagram)	XMC 0,na,nb	XMC? 0,nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 1470 <GMSK-NB,AB,SB>, 0 to 1550 <GMSK-Cont>, 0 to 1410 <8-PSK> (Data writing address) nb: -32768 to 32767 (Written data) nc: 0 to 1470 <GMSK-NB, AB, SB>, 0 to 1550 <GMSK-Cont>, 0 to 1410 <8-PSK> (Data reading address) nd: 1 to 1471 <GMSK-NB, AB, SB>, 1 to 1551 <GMSK-Cont>, 1 to 1411 <8-PSK> (Number of reading points) ne: -32768 to 32767 (Ideal signal for reading data"1"=10000)
	Q Data (Constellation, Eye Diagram)	XMC 1,na,nb	XMC? 1,nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 1470 <GMSK-NB,AB,SB>, 0 to 1550 <GMSK-Cont>, 0 to 1410 <8-PSK> (Data writing address) nb: -32768 to 32767 (Written data) nc: 0 to 1470 <GMSK-NB, AB, SB>, 0 to 1550 <GMSK-Cont>, 0 to 1410 <8-PSK> (Data reading address) nd: 1 to 1471 <GMSK-NB,AB,SB>, 1 to 1551 <GMSK-Cont>, 1 to 1411 <8-PSK> (Number of reading points) ne: -32768 to 32767 (Ideal signal for reading data"1"=10000)

Function	Item	Program Message	Query Message	Response Message	Remarks
Wave Data / Data Modify	EVM	XMV na,nb	XMV? nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 141 (Data writing address) nb: -32768 to 32767 (Written data) nc: 0 to 141 (Data reading address) nd: 1 to 142 (Number of reading points) ne: -32768 to 32767 (Read data 1%=100)
	Phase Error	XMP na,nb	XMP? nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 1470 <GMSK-NB, AB, SB>, 0 to 1550 <GMSK-Cont>, 0 to 141 <8-PSK> (Data writing address) nb: -32768 to 32767 (Written data) nc: 0 to 1470 <GMSK-NB, AB, SB>, 0 to 1550 <GMSK-Cont>, 0 to 141 <8-PSK> (Data reading address) nd: 1 to 1471 <GMSK-NB,AB,SB>, 1 to 1551 <GMSK-Cont>, 1 to 142 <8-PSK> (Number of reading points) ne: -32768 to 32767 (Read data 1deg=100)
	Magnitude Error	XMN na,nb	XMN? nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 470 (Data writing address) nb: -32768 to 32767 (Written data) nc: 0 to 1470 (Data reading address) nd: 0 to 1471 (Number of reading points) ne: -32768 to 32767 (Read data 1%=100)

RF Power

Function	Item	Program Message	Query Message	Response Message	Remarks
Window					
Window	Slot	WINDOW SLOT	WINDOW?	SLOT	
	On Portion	WINDOW ONPORT	WINDOW?	ONPORT	
	Frame	WINDOW FRAME	WINDOW?	FRAME	
	Leading	WINDOW LEAD	WINDOW?	LEAD	
	Trailing	WINDOW TRAIL	WINDOW?	TRAIL	
Storage Mode					
Storage Mode	Normal	STRG_RFPWR NRM	STRG_RFPWR ?	NRM	
	Average	STRG_RFPWR AVR	STRG_RFPWR ?	AVR	
Average Count		AVR_RFPWR n	AVR_RFPWR?	n	n: 2 to 9999
Reflesh Interval	Every	INTVAL_RFPWR EVERY	INTVAL_RFPWR?	EVERY	
	Once	INTVAL_RFPWR ONCE	INTVAL_RFPWR?	ONCE	
Marker					
Marker Mode	Normal	MKR_RFPWR NR	MMKR_RFPWR?	NRM	
	Off	MKR_RFPWR OFF	MKR_RFPWR?	OFF	
Marker Position		MKP_RFPWR r	MKP_RFPWR?	r	r: (Slot, On Portion) –27.0symbol to 174.0symbol, (Frame) –20.00symbol to 1274.0symbol, (Leading) –13.0symbol to 8.0symbol, (Trailing) 139.0symbol to 161.0symbol
Marker Level		---	MKL_RFPWR?	l	
Calibration					
Adjust Range		ADJRNG	---	---	
Power Calibration		PWRCAL	PWRCAL?	l	l: –10.00dB to 10.00dB
Calibration Cancel		CALCANCEL	---	---	
Calibration Value		CALVAL l	CALVAL?	n, l	n: mode (0: Not calibrated, 1: Internal calibration, 2: Externally input calibration) l : –10.00dB to 10.00dB
Level					
Level	Absolute Level	LVLREL OFF	LVLREL?	OFF	
	Relative Level	LVLREL ON	LVLREL?	ON	
Wide Dynamic Range	On	WIDE_RFPWR ON	WIDE_RFPWR?	ON	
	Off	WIDE_RFPWR OFF	WIDE_RFPWR?	OFF	

Function	Item	Program Message	Query Message	Response Message	Remarks
Setup Template					
Setup Template		DSPL SETTEMP_RFPWR	DSPL? DSPL?	SETTMP_RFPWR SETTMP_RFPWR	
		DSPL SETTEMP	DSPL?	SETTEMP_RFPWR	
Recall Template	Standard	SLCTTEMP_RFPWR STD	SLCTTEMP_RFPWR?	STD	
		SLCTTEMP	STDSLCTTEMP?	STD	
	Not Selected	---	SLCTTEMP_RFPWR?	NOT	
		---	SLCTTEMP?	NOT	
Template Type	NB at GMSK	TEMPTYPE_RFPWR NBGMSK	TEMPTYPE_RFPWR?	NBGMSK	
	AB	TEMPTYPE_RFPWR AB	TEMPTYPE_RFPWR?	AB	
	NB at 8-PSK	TEMPTYPE_RFPWR NB8PSK	TEMPTYPE_RFPWR?	NB8PSK	
	BTS1900 at GMSK	TEMPTYPE_RFPWR B19GMSK	TEMPTYPE_RFPWR?	B19GMSK	
Off Level	dBm	TEMPOFFLVL DBM	TEMPOFFLVL?	DBM	
	dB	TEMPOFFLVL DB	TEMPOFFLVL?	DB	
Level Modify	Upper	TEMPLVL_RFPWR UP,n,l	TEMPLVL_RFPWR? UP,n	l	n: 1 to 6
	Lower	TEMPLVL_RFPWR LOW,n,l	TEMPLVL_RFPWR? LOW,n	l	n: 1 to 3
Measure Result					
Tx Power	dBm	---	TXPWR? DBM	l	
	W	---	TXPWR? WATT	l	
Carrier Off Power	dBm	---	OFFPWR? DBM	l	
	W	---	OFFPWR? WATT	l	
On/Off Ratio		---	RATIO?	l	
Power Flatness	Maximum Power	---	MAXPWR?	l	
	Minimum Power	---	MINPWR?	l	
Template Judgement	Template On	---	TEMPPASS_RFPWR? ON	j	
		---	TEMPPASS? ON	j	
	Template Off	---	TEMPPASS_RFPWR? OFF	j	
		---	TEMPPASS? OFF	j	

Function Item	Program Message	Query Message	Response Message	Remarks
Wave Data/ Modify	XMD na,nb	XMD? nc,nd	ne(1),ne(2),...,ne(nd)	na: 0 to 13010 (Data writing address) nb: –32768 to 32767 (Written data 1dBm = 100) nc: 0 to 13010 (Start address for reading data) nd: 1 to 13011 (Number of read data) ne: –32768 to 32767 (Read data 1dBm = 100)
Slot Power (Remote Only)	---	SLOTPWR? n	1	n: 0 to 7 (slot number)
Reference Power for Template (Remote Only)	---	TEMPRPWR?	1	

Output RF Spectrum

Function	Item		Program Message	Query Message	Response Message	Remarks
Measure Method						
Measure Method	High Speed		DSPL ADJ,HIGH	DSPL?	ADJ,HIGH	
Measure Method & Measure Start	High Speed		MEAS ADJ,HIGH	MEAS?	ADJ,HIGH	
Storage Mode						
Storage Mode	Normal		STRG_ADJ	STRG_ADJ?	NRM	
	Average		STRG_ADJ	STRG_ADJ?	AVG	
Average Count			AVR_ADJ n	AVR_ADJ?	n	n: 2 to 9999
Reflesh Interval	Every		INTVAL_ADJ EVERY	INTVAL_ADJ?	EVERY	
	Once		INTVAL_ADJ ONCE	INTVAL_ADJ?	ONCE	
Unit						
Unit	dBm		UNIT_ADJ DBM	UNIT_ADJ?	DBM	
	dB		UNIT_ADJ DB	UNIT_ADJ?	DB	
Calibration						
Adjust Range			ADJRNG	---	---	
Power Calibration			PWRCAL	PWRCAL?	l	l: –10.00 dB to 10.00 dB
Calibration Cancel			CALCANCEL	---	---	
Calibration Value			CALVAL l	CALVAL?	n,l	n: mode (0: Not calibrated, 1: Internal calibration, 2: Externally input calibration) l: –10.00 dB to 10.00 dB
Measure Result						
Due to Modulation	Carrier Frequency		---	MODPWR?	l	
	Lower	current unit	---	MODPWR? Fn,LOW	l	n: 1 to 15
		designate unit	---	MODPWR? Fn,LOW, u	l	n: 1 to 15 u: dB or dBm
	Upper	current unit	---	MODPWR? Fn,UP	l	n: 1 to 15
		designate unit	---	MODPWR? Fn,UP,u	l	n: 1 to 15 u: dB or dBm
Switching Transients	Carrier Frequency		---	SWPWR?	l	
	Lower	currenmt unit	---	SWPWR? Fn,LOW	l	n: 1 to 15
		designate unit	---	SWPWR? Fn,LOW,u	l	n: 1 to 15 u: dB or dBm
	Upper	current unit	---	SWPWR? Fn,UP	l	n: 1 to 15
		designate unit	---	SWPWR? Fn,UP,u	l	n: 1 to 15 u: dB or dBm

Spurious Emission

Function	Item	Program Message	Query Message	Response Message	Remarks
Measure Method					
Spurious Mode	Spot	DSPL SPURIOUS,SPOT	DSPL?	SPURIOUS,SPOT	
	Search	DSPL SPURIOUS,SEARCH	DSPL?	SPURIOUS,SEARCH	
	Sweep	DSPL SPURIOUS,SWEEP	DSPL?	SPURIOUS,SWEEP	
Spurious Mode & Measure Start	Spot	MEAS SPURIOUS,SPOT	MEAS?	SPURIOUS,SPOT	
	Search	MEAS SPURIOUS,SEARCH	MEAS?	SPURIOUS,SEARCH	
	Sweep	MEAS SPURIOUS,SWEEP	MEAS?	SPURIOUS,SWEEP	
Unit					
Unit	dBm	UNIT_SPU DBM	UNIT_SPU?	DBM	
	dB	UNIT_SPU DB	UNIT_SPU?	DB	
Setup Frequency Table					
Setup Frequency Table	Spot	DSPL SETTBL_SPU,SPOT	DSPL?	SETTBL_SPU,SPOT	
	Search & Sweep	DSPL SETTBL_SPU, SWEEP	DSPL?	SETTBL_SPU, SWEEP	
Spot Table	Frequency	TBLFREQ_SPU SPOT,Fn,f	TBLFREQ_SPU? SPOT,Fn	f	n: 1 to 15 f: 100 Hz to 7.8 GHz (For MS8608A) f: 100 Hz to 13.2 GHz (For MS8609A)
	Harmonics	TBLFREQ_SPU SPOT,HRM	TBLFREQ_SPU? SPOT,Fn	f	n: 1 to 15 f: 100 Hz to 7.8 GHz (For MS8608A) f: 100 Hz to 13.2 GHz (For MS8609A)
	RBW	TBLRBW_SPU SPOT,Fn,f	TBLRBW_SPU? SPOT,Fn	f	n: 1 to 15 f: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz, 10 MHz, 20 MHz
Search and Sweep Table	Start Frequency	TBLFREQ_SPU START,Fn,f	TBLFREQ_SPU? START,Fn	f	n: 1 to 15 f: 1 kHz to 7799.999 MHz (For MS8608A) f: 1 kHz to 13999.999 MHz (For MS8609A)

Function	Item		Program Message	Query Message	Response Message	Remarks
Search and Sweep Table	Start Frequency Cancel		TBLFREQ_SPU START,Fn,0	TBLFREQ_SPU? START,Fn	0	n: 1 to 15
	Stop Frequency		TBLFREQ_SPU STOP,Fn,f	TBLFREQ_SPU? STOP,Fn	f	n: 1 to 15 f: 2 kHz to 7.8 GHz (For MS8608A) f: 2 kHz to 13.2 GHz (For MS8609A)
	Stop Frequency Cancel		TBLFREQ_SPU STOP,Fn,0	TBLFREQ_SPU? STOP,Fn	0	n: 1 to 15
	RBW		TBLRBW_SPU SWEEP,Fn,f	TBLRBW_SPU? SWEEP,Fn	f	n: 1 to 15 f: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 5MHz, 10MHz, 20MHz
RBW Mode	Auto	Spot	TBLRBWMD_SPU SPOT,AUTO	TBLRBWMD_SPU? SPOT	AUTO	
		Sweep/ Search	TBLRBWMD_SPU SPOT,AUTO	TBLRBWMD_SPU? SEARCH	AUTO	
	Manual	Spot	TBLRBWMD_SPU SEARCH,MAN	TBLRBWMD_SPU? SPOT	MAN	
		Sweep/ Search	TBLRBWMD_SPU SEARCH,MAN	TBLRBWMD_SPU? SEARCH	MAN	
Calibration						
Adjust Range			ADJRNG	---	---	
Power Calibration			PWRCAL	PWRCAL?	l	l: –10.00 dB to 10.00 dB
Calibration Cancel			CALCANCEL	---	---	
Calibration Value			CALVAL l	CALVAL?	n,l	n: mode (0: Not calibrated, 1: Internal calibration, 2: Externally input calibration) l: –10.00 dB to 10.00 dB
Preselector *Option						
Preselctor	Normal		BAND 0	BAND?	0	Effective only when the pre-selector option is installed
	Spurious		BAND 1	BAND?	1	Effective only when the pre-selector option is installed
Measure Result						
Tx Power			---	TXPWR? u	l	u: DBM or WATT
Frequency			---	SPUFREQ? Fna,nb	f1,f2,..,fnb	na: 1 to 15 (Frequency table No. to start reading) nb: 1 to 15 (Number of read data)

Function	Item	Program Message	Query Message	Response Message	Remarks
Level	current unit	---	SPULVL? Fna,nb	l1,l2,...,lnb	na: 1 to 15 (Frequency table No. to start reading) nb: 1 to 15 (Number of read data)
	designate unit	---	SPULVL? Fna,nb,u	l1,l2,...,lnb	na: 1 to 15 (Frequency table No. to start reading) nb: 1 to 15 (Number of read data) u: DBM, DB
Frequency and Level	current unit	---	SPUFREQLVL? Fna,nb	f1,l1,f2,l2,...,fnb,lnb	na: 1 to 15 (Frequency table No. to start reading) nb: 1 to 15 (Number of read data)
	designate unit	---	SPUFREQLVL? Fna,nb,u	f1,l1,f2,l2,...,fnb,lnb	na: 1 to 15 (Frequency table No. to start reading) nb: 1 to 15 (Number of read data) u: DBM, DB

Power Meter

Function	Item	Program Message	Query Message	Response Message	Remarks
Calibration					
Zero Set		ZEROSET	---	---	
		ZAJ	---	---	
Range					
Range Up		RNG UP	---	---	
Range Down		RNG DN	---	---	
Adjust Range		ADJRNG	---	---	
Range1		RNG1	---	---	
Range2		RNG2	---	---	
Range3		RNG3	---	---	
Range4		RNG4	---	---	
Range5		RNG5	---	---	
Set Relative		SETREL	---	---	
Measure Result					
Power	dBm	---	POWER? DBM	1	
	W	---	POWER? WATT	1	
	dB	---	POWER? DB	1	

IQ Level

Function	Item		Program Message	Query Message	Response Message	Remarks
Storage Mode						
Storage Mode	Normal		STRG_IQL NRM	STRG_IQL?	NRM	
	Average		STRG_IQL AVG	STRG_IQL?	AVG	
Average count			AVR_IQL nA	VR_IQL?	n	n: 2 to 9999
Refresh Interval	Every		INTVAL_IQL EVERY	INTVAL_IQL?	EVERY	
	Once		INTVAL_IQL ONCE	INTVAL_IQL?	ONCE	
Unit						
Unit	mV		UNIT_IQL MV	UNIT_IQL?	MV	
	dBmV		UNIT_IQL DBMV	UNIT_IQL?	DBMV	
Measure Result						
Level	All	current unit	---	IQLVL?	la,lb,lc,ld	la: I Level lb: Q Level lc: I p-p ld: Q p-p
		mV	---	IQLVL? MV	la,lb,lc,ld	la: I Level lb: Q Level lc: I p-p ld: Q p-p
		dBmV	---	IQLVL? DBMV	la,lb,lc,ld	la: I Level lb: Q Level lc: I p-p ld: Q p-p
	I	current unit	---	ILVL?	l	
		mV	---	ILVL? MV	l	
		dBmV	---	ILVL? DBMV	l	
	Q	current unit	---	QLVL?	l	
		mV	---	QLVL? MV	l	
		dBmV	---	QLVL? DBMV	l	
	I p-p	current unit	---	IPPLVL?	l	
		mV	---	IPPLVL? MV	l	
		dBmV	---	IPPLVL? DBMV	l	
	Q p-p	current unit	---	QPPLVL?	l	
		mV	---	QPPLVL? MV	l	
		dBmV	---	QPPLVL? DBMV	l	
Phase	I/Q difference		---	IQPHASE?	r	unit: deg

Section 7 Command Details

This Section explains the details of device messages and response messages used in the MX860802A/MX860902A GSM Measurement Software in alphabetical order.

For the list of these messages, see Section 6 Device Message List.

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How To Read the Detailed Description of Commands

Example: Setting impedance

IQINZ [1]

IQ Impedance [2]

[3]

Program Message	Query Message	Response Message
IQINZ a	IQINZ?	a

■ Function [4]
Sets the IQ signal input impedance on the Setup Common Parameter screen.

■ Value of a [5]
Impedance

a	Impedance	Initial value
50	50 Ω	*
1 M	1 MΩ	

■ Restriction [6]
Can not be set when Terminal is other than IQ-AC, IQ-DC or IQ-Balance.

■ Initialization of setting [7]
*RST

■ Example of use [8]
Sets the impedance to 50 Ω.

<Program>
TERM IQAC
IQINZ 50
IQINZ?

<Response>
50

[1] Message header for Program Message and Query Message
[2] Name of Setup/Recall item (Note: This is not always the same as that on the screen of measuring equipment.)
[3] Syntax for Program Message, Query Message and Response Message.
Upper-case letters represent the reserved words. Lower-case letters represent the argument for the device message described in [5] or the response data.
[4] Outline of Setup/Recall function in Program Message and Query Message
[5] Description of lower-case letters in table of [3].
In case of set value; each argument includes the meaning of set item, initial value, range, resolution and restrictions.
In case of Response Message, each argument includes the meaning of output data, resolution, unit, etc.
[6] Description of restrictions and precautions in using the command. The command is not properly set or recalled if these restrictions are not met.
[7] A Program Message that initializes the items set by this command.

[8] An example of command use. The example of <Program> is given here only to show the examples of Program Message, Query Message and their order. It is not an actual program code. (Program code depends on the environment.) The values in <Response> differ from the actual measured values.

ADJRNG

Adjust Range

Program Message	Query Message	Response Message
ADJRNG	—	—

■ Function

Optimizes internal ATT and A/D levels.

■ Application Example

"Optimizing the measurement range."

<Program>
ADJRNG

AVR_ADJ

Average Count for Output RF Spectrum

Program Message	Query Message	Response Message
AVR_ADJ a	AVR_ADJ?	a

■ Function

Sets the average (measurement) count on the Output RF Spectrum screen obtained when the Storage Mode is set to Average.

■ Value a

Average (measurement) count

Range	Resolution	Initial value
2 to 9999	1	10

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting Average Count at 500."

<Program>
MEAS ADJ,HIGH
AVR_ADJ 500
AVR_ADJ?

<Response>
500

AVR_IQL

Average Count for IQ Level

Program Message	Query Message	Response Message
AVR_IQL a	AVR_IQL?	a

■ Function

Sets the measuring (average) count on the IQ Level screen obtained when the Storage Mode is set to Average.

■ Value a

Measuring (average) count

Range	Resolution	Initial value
2 to 9999	1	10

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting Average Count at 50."

<Program>
DSPL IQLVL
STRG_IQL AVG
AVR_IQL 50
AVR_IQL?
SNGLS

<Response>
50

AVR_MOD

Average Count for Modulation Analysis

Program Message	Query Message	Response Message
AVR_MOD a	AVR_MOD?	a

■ Function

Sets the average (measurement) count on the Modulation Analysis screen obtained when the Storage Mode is set to Average.

■ Value a

Average (measurement) count

Range	Resolution	Initial value
2 to 9999	1	10

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting Average Count at 500."

<Program>
MEAS MODANAL
AVR_MOD 500
AVR_MOD?

<Response>
500

AVR_RFPWR

Average Count for RF Power

Program Message	Query Message	Response Message
AVR_RFPWR a	AVR_RFPWR?	a

■ Function

Sets the average (measurement) count on the RF Power screen obtained when the Storage Mode is set to Average.

■ Value a

Average (measurement) count

Range	Resolution	Initial value
2 to 9999	1	10

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting Average Count at 500."

<Program>
MEAS RFPWR
AVR_RFPWR 500
AVR_RFPWR?

<Response>
500

BAND

Preselector

Program Message	Query Message	Response Message
BAND a	BAND?	a

■ Function

Sets the route to be measured prior to signal measurement.

■ Value a

Normal/Spurious

a	Preselector	Initial value
0	Normal	*
1	Spurious	

■ Setting initialization

*RST

■ Application Example

"Setting Preselector at Spurious."

<Program>
BAND 1
BAND?

<Response>
1

■ Notes

* This function is optional.

BS

Back Screen

Program Message	Query Message	Response Message
BS	—	—

■ Function

Switches the currently displayed screen to the previous one.

■ Application Example

"Shifting to the upper screen."

<Program>

BS

CALCANCEL

Power Calibration Cancel

Program Message	Query Message	Response Message
CALCANCEL	—	—

■ Function

Cancels Power Calibration and resets the calibration value to 0.00.

■ Application Example

"Canceling Power Calibration."

<Program>
CALVAL 10.00DB
CALVAL ?
CALCANCEL
CALVAL?

<Response>
2,10.00
0,0.00

CALVAL

Power Calibration Value

Program Message	Query Message	Response Message
CALVAL a	CALVAL?	b, a

■ Function

Sets the calibration value for Power Calibration.

■ Value a

Calibration value

Range	Resolution	Initial value	Unit
–10.00 to 10.00	0.01	0.00	dB

☐ Suffix code

None : dB

DB : dB

■ Value b

Type of calibration

b	Type of calibration	Initial value
0	Yet to be calibrated	*
1	Internal calibration	
2	External calibration	

■ Setting initialization

<Preset + Power On>

■ Application Example

"Setting the calibration value at 5 dB."

<Program>

CALVAL 5.00

CALVAL?

<Response>

2,5.00

CARRF

Carrier Frequency

Program Message	Query Message	Response Message
–	CARRF?	a

■ Function

Outputs the carrier frequency on the Modulation Analysis screen.

■ Value a

Carrier frequency

Resolution	Unit
0.1	Hz

■ Application Example

"Reading out the carrier frequency."

<Program>
MEAS MODANAL
CARRF?

<Response>
890199998.8

CARRFERR

Carrier Frequency Error

Program Message	Query Message	Response Message
—	CARRFERR? a	b

■ Function

Outputs the carrier frequency error on the Modulation Analysis screen.

■ Value a

Output unit

a	Output unit
None	Hz
HZ	Hz
PPM	ppm

■ Value b

Frequency error

Resolution	Unit (Depends on an alternative selected in a.)
0.1	Hz
0.01	ppm

■ Application Example

"Reading out the carrier frequency error."

<Program>
MEAS MODANAL
CARRFERR? HZ

<Response>
–14.5

CHAN

Channel

Program Message	Query Message	Response Message
CHAN a	CHAN?	a

■ Function

Sets the channel on the Setup Common Parameter screen.

■ Value a

Channel

Range	Resolution	Initial value
0 to 20000	1	1

■ Constraints

- No setting is allowed when the terminal is other than RF.
- When the value representing Channel Spacing causes the frequency to go beyond the setting range, the channel cannot be changed even within the setting range of the channel.

■ Setting initialization

*RST

■ Application Example

"Setting the channel to 5."

<Program>
TERM RF
CHAN 5
CHAN?

<Response>
5

CHFREQ

Channel and Frequency

Program Message	Query Message	Response Message
CHFREQ a, b	—	—

■ Function

Sets the channel and the frequency of the channel concurrently on the Setup Common Parameter screen.

■ Value a

Channel

Range	Resolution	Initial value
0 to 20000	1	1

■ Value b : Carrier frequency

Range	Resolution	Initial value	Unit	Remarks
100 to 7800000000	1	890200000	Hz	For MS8608A
100 to 13200000000	1	890200000	Hz	For MS8609A

☐ Suffix code

None : Hz
HZ : Hz
KHZ, KZ : kHz
MHZ, MZ: MHz
GHZ, GZ : GHz

■ Constraint

- No setting is allowed when the terminal is one other than RF.

■ Setting initialization

*RST

■ Application Example

"Setting the carrier frequency of Channel 2 to 1 GHz."

<Program>
TERM RF
CHFREQ 2,1 GHZ
CHAN?
FREQ?

<Response>
2
1000000000

CHSPC

Channel Spacing

Program Message	Query Message	Response Message
CHSPC a	CHSPC?	a

■ Function

Sets the inter-channel frequency band on the Setup Common Parameter screen.

■ Value a

Inter-channel frequency band

Range	Resolution	Initial value	Unit
0 to 7800000000	1	200000	Hz

☐ Suffix code

None : Hz
HZ : Hz
KHZ, KZ : kHz
MHZ, MZ: MHz
GHZ, GZ : GHz

■ Constraint

- No setting is allowed when the terminal is other than RF.

■ Setting initialization

*RST

■ Application Example

"Setting the inter-channel frequency band to 300 kHz."

<Program>
TERM RF
CHAN 1
FREQ 400MHZ
CHSPC 300KHZ
CHSPC?
CHAN 2
FREQ?

<Response>
300000
400300000

CONTS

Continuous Sweep

Program Message	Query Message	Response Message
CONTS	—	—

■ Function

Executes continuous sweep.

■ Application Example

"Executing continuous sweep."

<Program>
CONTS

CORR

Correction

Program Message	Query Message	Response Message
CORR a	CORR?	a

■ Function

Selects the Correction data table for level correction.

■ Value a

Correction data table

a	Correction data table	Initial value
0	No data correction is carried out.	*
1	Table1	
2	Table2	
3	Table3	
4	Table4	
5	Table5	

■ Setting initialization

*RST

■ Application Example

"Selecting Correction Data Table 3."

<Program>
CORR 3
CORR?

<Response>
3

DSPL

Switch Screen

Program Message	Query Message	Response Message
DSPL a,b DSPL a	DSPL?	a,b

■ Function

Sets the measurement screen and measuring method without starting measurement.

■ Values a and b

a: Name of the measurement screen

b: Measuring method/Type of template

a	b	Name of the measurement screen	Measuring method/ Type of template	Initial value	Input Terminal
SETCOM	---	Setup Common Paramter	---	*	RF, IQ-DC, IQ-AC, IQ-Balance
MODANAL	---	Modulation Ananlysis	---		
RFPWR	---	RF Power	---		
SETTEMP_RFPWR SETTEMP*	---	Setup Template for RF Power	---		
ADJ	HIGH	Output RF Spectrum	High Speed		RF
SPURIOUS	SPOT	Spurious Emission	Spot		
	SEARCH		Search		
	SWEEP		Sweep		
SETTBL_SPU	SPOT	Setup Frequency Table for SpuriousEmission	Spot		
	SWEEP		Search & Sweep		
PWRMTR	---	Power Meter	---		
IQLVL	---	IQ Level	---		IQ-DC, IQ-AC, IQ-Balance

* The response message to the program message "DSPL SETTEMP" is "SETTEMP_RFPWR."

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

[1] "Shifting to the Modulation Analysis screen."

<Program>

DSPL MODANAL

DSPL?

<Response>

MODANAL

[2] "Shifting to sweep measurement on the Spurious Emission screen."

<Program>

DSPL SPURIOUS, SWEEP

DSPL?

<Response>

SPURIOUS, SWEEP

EVM95PCT

95:th percentile EVM

Program Message	Query Message	Response Message
—	EVM95PCT?	a

■ Function

Outputs the measured results of 95:th percentile EVM on the Modulation Analysis screen.

■ Value a

95:th percentile EVM

Resolution	Unit
0.01	%

■ Application Example

"Reading out the measurement results of 95:th percentile EVM."

<Program>
DSPL MODANAL
SWP
EVM95PCT?

<Response>
–34.33

FILTER

Filter

Program Message	Query Message	Response Message
FILTER a	FILTER?	a

■ Function

Sets filter processing on the Modulation Analysis screen performed when the modulation type is set at 8-PSK.

■ Value a

Filter processing and type

a	Filter processing and type	Initial value
NON	No filter processing is carried out.	
NYQST	Root Nyquist filter	
NYQSTINVS	Root Nyquist filter and inverse filter	
SPEC	GSM filter processing using a measurement filter for 90 kHz	*

■ Setting initialization

PRE, INI, IP, *RST

■ Constraint

- Setting is allowed only when the modulation type is set at 8-PSK.

■ Application Example

"Carrying out filter processing using the root Nyquist filter."

<Program>
MODTYPE 8PSK
MEAS MODANAL
FILTER NYQST
FILTER?

<Response>
NYQST

FREQ

Frequency

Program Message	Query Message	Response Message
FREQ a	FREQ?	a

■ Function

Sets the carrier frequency for the frequency to be measured on the Setup Common Parameter screen.

■ Value a

Carrier frequency

Range	Resolution	Initial value	Unit	Remarks
100 to 7800000000	1	890200000	Hz	For MS8608A
100 to 13200000000	1	890200000	Hz	For MS8609A

□ Suffix code

None : Hz
HZ : Hz
KHZ, KZ : kHz
MHZ, MZ: MHz
GHZ, GZ : GHz

■ Constraint

- No setting is allowed when the terminal is one other than RF.

■ Setting initialization

*RST

■ Application Example

"Setting the carrier frequency to 1 GHz."

<Program>
TERM RF
FREQ 1 GHZ

<Response>
1000000000

ILVL

I Level (RMS)

Program Message	Query Message	Response Message
—	ILVL? a	b

■ Function

Reads out the measured results of the RMS value of Signal I on the IQ Level screen.

■ Value a

Readout unit

a	Readout unit
None	Existing setting unit
MV	mV
DBMV	dBmV

■ Value b

RMS value of Signal I

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the RMS value of Level I."

<Program>
MEAS IQLVL
ILVL? MV

<Response>
1.42

INI

Initialize

Program Message	Query Message	Response Message
INI	—	—

■ Function

Initializes all the measurement control parameters that need to be initialized. This function has the same effect as the PRE and IP commands.

■ Application Example

"Initializing the parameters that need to be initialized."

<Program>
INI

INTPOL

Interpolation for Constellation

Program Message	Query Message	Response Message
INTPOL a	INTPOL?	a

■ Function

Sets the interpolation display on the Modulation Analysis screen obtained when Trace Format is set at Constellation.

■ Value a

Interpolation display

a	Interpolation mode	Initial value
NON	Non : Displays only the symbol point.	*
LIN	Linear : Displays the linearly interpolated symbol point.	
POINT10	10points : Displays the interval between the symbol points interpolated among 10 segments.	
LINSYM	Linear & Symbol Position : Displays the symbol point and the linearly interpolated symbol point.	
P10SYM	10points & Symbol Position : Displays the symbol point and the interval between symbol points interpolated among 10 segments.	

■ Constraint

- No setting is allowed when Trace Format is set to other than Constellation.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Linearly interpolating the symbol point."

<Program>
MEAS MODANAL
TRFORM CONSTEL
INTPOL LIN
INTPOL?

<Response>
LIN

INTVAL_ADJ

Refresh Inetrval for Output RF Spectrum

Program Message	Query Message	Response Message
INTVAL_ADJ a	INTVAL_ADJ?	a

■ Function

Sets the display updating interval on the Output RF Spectrum screen obtained when the Storage Mode is set to Average.

■ Value a

Updating interval

a	Updating interval	Initial value
EVERY	Updated after every sweep. An average is obtained based on the frequency of measurements conducted.	*
ONCE	Updated after every averaging. An average is obtained based on the frequency specified by Average Count.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the updating interval to Once."

<Program>
MEAS ADJ, HIGH
INTVAL_ADJ ONCE
INTVAL_ADJ?

<Response>
ONCE

INTVAL_IQL

Refresh Inetrval for IQ Level

Program Message	Query Message	Response Message
INTVAL_IQL a	INTVAL_IQL?	a

■ Function

Sets the method for updating the measured results on the IQ Level screen when the Storage Mode is set to Average.

■ Value a

Updating method

a	Updating method	Initial value
EVERY	Displays the average value of the measured results obtained after every measurement.	*
ONCE	Displays the average value of the measurement results after measurement of Average Count is completed.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Updating the display after every averaging."

<Program>
DSPL IQLVL
STRG_IQL AVG
INTVAL_IQL ONCE
INTVLA_IQL?
SNGLS

<Response>
ONCE

INTVAL_MOD

Refresh Inetrval for Modulation Analysis

Program Message	Query Message	Response Message
INTVAL_MOD a	INTVAL_MOD?	a

■ Function

Sets the display updating interval on the Modulation Analysis screen obtained when the Storage Mode is set to Average.

■ Value a

Updating interval

a	Updating interval	Initial value
EVERY	Updated after every sweep. An average is obtained based on the frequency of measurements conducted.	*
ONCE	Updated after every averaging. An average is obtained based on the frequency specified by Average Count.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the updating interval to Once."

<Program>
MEAS MODANAL
INTVAL_MOD ONCE
INTVAL_MOD?

<Response>
ONCE

INTVAL_RFPWR

Refresh Inetrval for RF Power

Program Message	Query Message	Response Message
INTVAL_RFPWR a	INTVAL_RFPWR?	a

■ Function

Sets the display updating interval on the RF Power screen obtained when the Storage Mode is set to Average.

■ Value a

Updating interval

a	Updating interva	Initial value
EVERY	Updated after every sweep. An average is obtained based on the frequency of measurements conducted.	*
ONCE	Updated after every averaging. An average is obtained based on the frequency specified by Average Count.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the updating interval to Once."

<Program>
MEAS RFPWR
INTVAL_RFPWR ONCE
INTVAL_RFPWR?

<Response>
ONCE

IP

Preset

Program Message	Query Message	Response Message
IP	—	—

■ Function

Initializes all the measurement control parameters that need to be initialized. This function has the same effect as the PRE and INI commands.

■ Application Example

"Initializing the parameters that need to be initialized."

<Program>
IP

IPPLVL

I Level (Peak to Peak)

Program Message	Query Message	Response Message
—	IPPLVL? a	b

■ Function

Reads out the measured results of the Peak to Peak value of Signal I on the IQ Level screen.

■ Value a

Readout unit

a	Readout unit
None	Existing setting unit
MV	mV
DBMV	dBmV

■ Value b

Peak to Peak value of Signal I

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the Peak to Peak value of Level I."

<Program>
MEAS IQLVL
IPPLVL? MV

<Response>
4.07

IQINZ

IQ Impedance

Program Message	Query Message	Response Message
IQINZ a	IQINZ?	a

■ Function

Sets the input impedance of Signal IQ on the Setup Common Parameter screen.

■ Value a

Impedance

a	Impedance	Initial value
50	50 Ω	*
1 M	1 MΩ	

■ Constraint

- No setting is allowed when the terminal is one other than IQ-AC, IQ-DC or IQ-Balance.

■ Setting initialization

*RST

■ Application Example

"Setting the impedance value at 50 Ω."

<Program>
TERM IQAC
IQINZ 50
IQINZ?

<Response>
50

IQLVL

IQ Level

Program Message	Query Message	Response Message
—	IQLVL? a	b, c, d, e

■ Function

Reads out the measured results of the RMS value and Peak to Peak value of Signal I and Signal Q on the IQ Level screen.

■ Value a

Readout unit

a	Readout unit
None	Existing setting unit
MV	mV
DBMV	dBmV

■ Values, b, c, d and e

b: RMS value of Signal I
c: RMS value of Signal Q
d: Peak to Peak value of Signal I
e: Peak to Peak value of Signal Q

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the IQ Level value."

<Program>
MEAS IQLVL
IQLVL? MV

<Response>
1.42, 0.53, 4.07, 3.55

IQPHASE

IQ Phase difference

Program Message	Query Message	Response Message
—	IQPHASE?	a

■ Function

Reads out the measurement results of phase difference for Signal IQ on the IQ Level screen.

■ Value a

Phase difference of IQ

Resolution	Unit
0.01	deg

■ Application Example

"Reading out the phase difference for IQ."

<Program>
MEAS IQLVL?
IQPHASE?

<Resopnse>
99.97

LVLREL

Relative Level

Program Message	Query Message	Response Message
LVLREL a	LVLREL?	a

■ Function

Sets the relative display of the waveform on the RF Power screen. When the relative value display is on, average intra-burst power forms the reference value. In addition, when the relative value display is on, no template can be displayed.

■ Value a

On/Off of the relative value display

a	On/Off of the relative value display	Initial value
ON	Relative Level : Displays the vertical scale of the waveform using the relative value (unit of dB).	*
OFF	Absolute Level : Displays the vertical scale of the waveform using the absolute value (unit of dBm).	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the waveform using the absolute value."

<Program>
MEAS RFPWR
LVLREL OFF
LVLREL?

<Response>
OFF

MAGTDERR

RMS Magnitude Error

Program Message	Query Message	Response Message
—	MAGTDERR?	a

■ Function

Outputs the measurement results of the RMS value of Magnitude Error on the Modulation Analysis screen.

■ Value a

RMS value of Magnitude Error

Resolution	Unit
0.01	%

■ Application Example

"Reading out the measurement results of Magnitude Error."

<Program>
DSPL MODANAL
SWP
MAGTDERR?

<Response>
16.67

MAXPWR

Maximum Power

Program Message	Query Message	Response Message
—	MAXPWR?	a

■ Function

Outputs maximum intra-burst power in a single frame in the form of the relative value of average intra-burst power on the RF Power screen.

■ Value a

Maximum intra-burst power

Resolution	Unit
0.01	dB

■ Application Example

"Reading out maximum power."

<Program>
DSPL RFPWR
SWP
MAXPWR?

<Response>
0.06

MEAS

Switch Screen and Measure Start

Program Message	Query Message	Response Message
MEAS a,b MEAS a	MEAS?	a,b

■ Function

Shifts to the measurement screen and executes sweep in Single mode.

■ Values a and b

a: Name of the measurement screen

b: Measuring method/Type of template

a	b	Name of the measurement screen	Measuring method/Type of template	Initial value	Input Terminal
SETCOM	---	Setup Common Paramter	---	*	RF, IQ-DC, IQ-AC, IQ-Balance
MODANAL	---	Modulation Ananlysis	---		
RFPWR	---	RF Power	---		
SETTEMP_RFPWR SETTEMP*	---	Setup Template for RF Power	---		
ADJ	SWEEP *1	Output RF Spectrum	Spectrum (Sweep)		RF
	ZERO *1		Spectrum (Zero Span)		
	HIGH		High Speed		
SETTBL_ADJ *1	---	Setup Frequency Table for Output RF Spectrum	---		
SPURIOUS	SPOT	Spurious Emission	Spot		
	SEARCH		Search		
	SWEEP		Sweep		
SETTBL_SPU	SPOT	Setup Frequency Table for Spurious Emission	Spot		
	SWEEP		Search & Sweep		
PWRMTR	---	Power Meter	---		
IQLVL	---	IQ Level	---		IQ-DC, IQ-AC, IQ-Balance

* The response message to the program message, "MEAS SETTEMP", is "SETTEMP_RFPWR."

■ Application Example

[1] "Executing a measurement on the Modulation Analysis screen."

<Program>
MEAS MODANAL
MEAS?

<Response>
MODANAL

[2] "Executing sweep measurement on the Spurious Emission screen."

<Program>
MEAS SPURIOUS, SWEEP
MEAS?

<Response>
SPURIOUS, SWEEP

MEASOBJ

Measuring Object

Program Message	Query Message	Response Message
MEASOBJ a	MEASOBJ?	a

■ Function

Sets the type of burst signal to be analyzed on the Setup Common Parameter screen.

■ Value a

Type of burst signal

a	Type of burst signal	Initial value
NB	Normal Burst	*
AB	Access Burst	
SB	Synchronization Burst	
CONT	Continuous	

■ Constraint

- No setting is allowed for Access Burst and Synchronization Burst when the modulation type is set at 8-PSK.

■ Setting initialization

*RST

■ Application Example

"Setting Access Burst as the analysis target."

<Program>
MODTYPE GMSK
MEASOBJ AB
MEASOBJ?

<Response>
AB

MINPWR

Minimum Power

Program Message	Query Message	Response Message
—	MINPWR?	a

■ Function

Outputs intra-burst minimum power in a single frame in the form of the relative value of average intra-burst power on the RF Power screen.

■ Value a

Intra-burst minimum power

Resolution	Unit
0.01	dB

■ Application Example

"Reading out intra-burst minimum power."

<Program>
DSPL MODANAL
SWP
MINPWR?

<Response>
–0.12

MKL_MOD

Marker Level for Modulation Analysis

Program Message	Query Message	Response Message
—	MKL_MOD? a	b

■ Function

Reads out the measured value at each marker position on the Modulation Analysis screen.

■ Value a

Type of output signal

a	Type of signal to be output
None	Outputs previously set Trace Format from among Trellis, Eye Diagram, Phase Error, and Magnitude Error.
I	Signal I (Setting is allowed only when the Trace Format is set to Constellation or Eye Diagram.)
Q	Signal Q (Setting is allowed only when the Trace Format is set to Constellation or Eye Diagram.)

■ Value b

Marker Level

Trace Format	Resolution	Unit
Constellation	0.0001	None
Trellis	0.1	deg
Eye Diagram	0.0001	None
Phase Error	0.01	deg
Magnitude Error	0.01	%

■ Constraints

- When the Trace Format is set to other than Constellation, Eye Diagram, Phase Error or Magnitude Error, *** is output.
- When marker mode is set to off, *** is output.

■ Application Example

"Reading out the phase error at 128.0 symbol."

<Program>
MEAS MODANAL
TRFORM PHASE
MKR_MOD NRM
MKP_MOD 128.0
MKL_MOD?

<Response>
1.54

MKL_RFPWR

Marker Level for RF Power

Program Message	Query Message	Response Message
—	MKL_RFPWR?	a

■ Function

Reads out the Power value at the marker position on the RF Power screen.

■ Value a

Power

Resolution	Unit
0.01	dB

■ Restraint

- When marker mode for RF power is off, *** is output.

■ Application Example

"Reading out the Power level at 80.0 symbol of the frame window."

<Program>
DSPL RFPWR
WINDOW FRAME
MKR_RFPWR NRM
MKP_RFPWR 80.0
SWP
MKL_RFPWR?

<Response>
–10.62

MKP_MOD

Marker Position for Modulation Analysis

Program Message	Query Message	Response Message
MKP_MOD a	MKP_MOD?	a

■ Function

Specifies the marker position on the Modulation Analysis screen.

■ Value a

Marker position

Range	Modulation Type	Trace Format	Resolution	Initial value	Unit
0.0 to 147.0	GMSK	Constellation	1.0	73.0	symbol
		Eye Diagram, Phase Error, Magnitude Error, Trellis	0.1	73.5	
3.0 to 144.0	8-PSK	Constellation, EVM, Phase Error, Magnitude Error	1.0	73.0	
		Eye Diagram	0.1	73.5	

■ Constraints

- No setting is allowed when the Trace Format is set to None.
- No setting is allowed when marker mode is set to off.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying a marker at 128bit on the Phase Error display."

<Program>
MEAS MODANAL
TRFORM PHASE
MKR_MOD NRM
MKP_MOD 128.0
MKP_MOD?

<Response>
128.0

MKP_RFPWR

Marker Position for RF Power

Program Message	Query Message	Response Message
MKP_RFPWR a	MKP_RFPWR?	a

■ Function

Specifies the marker position on the RF Power screen.

■ Value a

Marker position

Range	Window	Resolution	Initial value	Unit
–27.0 to 174.0	Slot, On Portion	0.1	73.5	Symbol
–20.0 to 1274.0	Frame	0.1	73.5	Symbol
–13.0 to 8.0	Leading	0.1	–2.5	Symbol
139.0 to 161.0	Trailing	0.1	150.0	Symbol

■ Constraint

- No setting is allowed when marker mode for RF power is off.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Marking 80.0 symbol of the frame window."

<Program>
MEAS RFPWR
WINDOW FRAME
MKR_RFPWR NRM
MKP_RFPWR 80.0
MKP_RFPWR?

<Response>
80.0

MKR_MOD

Marker Mode

Program Message	Query Message	Response Message
MKR_MOD a	MKR_MOD?	a

■ Function

Sets the marker on/off on the Modulation Analysis screen.

■ Value a

Marker setting

a	Marker setting	Initial value
NRM	Normal : Displays the marker and sets the marker position to the entry state.	
OFF	Off : Deletes the marker display and cancels the entry state of the marker position.	*

■ Constraint

- No setting is allowed when the Trace Format is set to Non.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the marker."

<Program>
MEAS MODANAL
TRFORM PHASE
MKR_MOD NRM
MKR_MOD?

<Response>
NRM

MKR_RFPWR

Marker Mode for RF Power

Program Message	Query Message	Response Message
MKR_MOD a	MKR_MOD?	a

■ Function

Sets the marker on/off on the RF Power screen.

■ Value a

Marker setting

a	Marker setting	Initial value
NRM	Normal : Displays the marker and sets the marker position to the entry state.	
OFF	Off : Deletes the marker display and cancels the entry state of the marker position.	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting marker to on."

<Program>
MEAS RFPWR
MKR_RFPWR NRM
MKR_RFPWR?

<Response>
NRM

MODPWR

Due to Modulation

Program Message	Query Message	Response Message
—	MODPWR? Fa,b,c	d

■ Function

Reads out the Due to Modulation value on the Output RF Spectrum screen.

■ Value a

Frequency table

Range	Resolution
1 to 15	1

■ Value b

Lower/Upper

b	Lower/Upper
UP	Upper
LOW	Lower

■ Value c

Output unit

c	Output unit
DB	dB
DBM	dBm

■ Constraints

- When no value a, b or c is set, the carrier frequency level is read out in dBm units.
- When only the value c is not set, readout takes place in the unit set by Unit for Output RF Spectrum.

■ Application Example

[1] "Reading out Due to Modulation of the carrier frequency."

<Program>
DSPL ADJ,HIGH
SWP
MODPWR?

<Response>
–39.56

[2] "Reading out Due to Modulation on the Upper side of Frequency Table f6 in dB."

<Program>
DSPL ADJ, HIGH
SWP
MODPWR? F6, UP, DB

<Response>
–42.99

MODTYPE

Modulation Type

Program Message	Query Message	Response Message
MODTYPE a	MODTYPE?	a

■ Function

Sets the modulation system that needs to be measured on the Setup Common Parameter screen.

■ Value a

Modulation system

a	Modulation system	Initial value
GMSK	GMSK	*
8PSK	8-PSK	

■ Setting initialization

*RST

■ Application Example

"Setting the modulation system to be measured to 8-PSK."

<Program>
DSPL SETCOM
MODTYPE 8PSK
MODTYPE?

<Response>
8PSK

OFFPWR

Carrier Off Power

Program Message	Query Message	Response Message
—	OFFPWR? a	b

■ Function

Displays average power when single-frame transmission is set to off on the RF Power screen.

■ Value a

Output unit

a	Output unit
DBM	dBm
WATT	W

■ Value b

Average power when transmission is set to off.

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out average power when transmission is set to off."

<Program>
DSPL RFPWR
SWP
OFFPWR? DBM

<Response>
–47.63

ORGNOFS

Origin Offset

Program Message	Query Message	Response Message
—	ORGNOFS?	a

■ Function

Outputs the measurement results for zero-offset (carrier leak component) of the signal to be measured on the Modulation Analysis screen.

■ Value a

Origin Offset value

Resolution	Unit
0.01	dB

■ Application Example

"Reading out the Origin Offset value."

<Program>
DSPL MODANAL
SWP
ORGNOFS?

<Response>
–34.33

PATT

Training Sequence Pattern

Program Message	Query Message	Response Message
PATT a	PATT?	a

■ Function

Sets the type of Training Sequence on the Setup Common Parameter screen.

■ Value a

Training Sequence

a	Training Sequence	Initial value	Measuring Object
TSC0	TSC0	*	Normal Burst
TSC1	TSC1		
TSC2	TSC2		
TSC3	TSC3		
TSC4	TSC4		
TSC5	TSC5		
TSC6	TSC6		
TSC7	TSC7		
ETSC	096FF335478	*	Access Burst
SYNCH	B962040F2D45761B	*	Synchronization Burst
NO	No Training Sequence is carried out.		Normal Burst Access Burst Synchronization Burst
USER	The user sets the Training Sequence.		Normal Burst Access Burst Synchronization Burst

■ Constraint

- No setting is allowed when the Measuring Object is set to Continuous.

■ Setting initialization

*RST

■ Application Example

"Setting the Training Sequence to TSC1."

<Program>
MEASOBJ NB
PATT TSC1
PATT?

<Response>
TSC1

PATT_UBIT

Training Sequence Bit Pattern by user setting

Program Message	Query Message	Response Message
PATT_UBIT a	PATT_UBIT?	a

■ Function

Sets the Training Sequence Bit Pattern on the Setup Common Parameter screen obtained when the Training Sequence is set by the user.

■ Value a

Range*	Modulation system	Resolution	Initial value	Unit
0 to FFFFFFFFFFFFFFFF	GMSK	1	0000000	bit
0 to 777777777777777777777777	8-PSK	1	000000000	bit

* The setting range is determined with the value representing the User Pattern Length.

■ Constraints

- No setting is allowed when the Measuring Object is set to Continuous.
- No setting is allowed when the Training Sequence Bit Pattern is set by other than User.

■ Setting initialization

*RST

■ Application Example

"Setting the user defined Training Sequence bit pattern to FFFF."

<Program>
MODTYPE GMSK
MEASOBJ NB
PATT USER
PATT_ULEN 16
PATT_UBIT FFFF
PATT_UBIT?

<Response>
FFFF

PATT_ULEN

Training Sequence Length by User setting

Program Message	Query Message	Response Message
PATT_ULEN a	PATT_ULEN?	a

■ Function

Sets the Training Sequence length on the Setup Common Parameter screen obtained when the Training Sequence is set by the user.

■ Value a

Training Sequence length

Range	Modulation system	Resolution	Initial value	Unit
1 to 64	GMSK	1	26	symbol
1 to 26	8-PSK	1	26	symbol

■ Constraints

- No setting is allowed when the Measuring Object is set to Continuous.
- No setting is allowed when the Training Sequence Pattern is set by other than User.

■ Setting initialization

*RST

■ Application Example

"Setting the Training Sequence length of the normal burst to 64 symbol."

<Program>
MODTYPE GMSK
MEASOBJ NB
PATT USER
PATT_ULEN 64
PATT_ULEN?

<Response>
64

PATT_USTART

Start Point of Training Sequence by user setting

Program Message	Query Message	Response Message
PATT_USTARTa	PATT_USTART?	a

■ Function

Sets a position in a single burst as the starting position of the Training Sequence on the Setup Common Parameter screen when the Training Sequence is set by the user.

■ Value a

Starting position of the Training Sequence

Range	Modulation system	Measuring Object	Resolution	Initial value	Unit
0 to (87 - User Pattern Length)	GMSK	AB	1	61	bit
0 to (147 - User Pattern Length)		Other than AB			
0 to (147 - User Pattern Length)	8-PSK	NB			symbol

■ Constraints

- No setting is allowed when the Measuring Object is set to Continuous.
- No setting is allowed when the Training Sequence Pattern is set by other than User.

■ Setting initialization

*RST

■ Application Example

"Setting the starting bit of the Training Sequence to bit 0."

<Program>
MODTYPE GMSK
MEASOBJ NB
PATT USER
PATT_USTART 0
PATT_USTART?

<Response>
0

PHASEERR

RMS Phase Error

Program Message	Query Message	Response Message
—	PHASEERR?	a

■ Function

Outputs the RMS value of the phase error in a single burst on the Modulation Analysis screen.

■ Value a

RMS value of the phase error in a single burst

Resolution	Unit
0.01	deg

■ Application Example

"Reading out the RMS value of the phase error."

<Program>
MEAS MODANAL
PHASEERR?

<Response>
2.71

PMAGTDERR

Peak Magnitude Error

Program Message	Query Message	Response Message
—	PMAGTDERR? a	b

■ Function

Outputs the maximum instantaneous value for Magnitude Error on the Modulation Analysis screen.

■ Value a

Magnitude Error positive/negative sign

a	Positive/Negative sign
None	Peak value
+	Positive peak value
−	Negative peak value

■ Value b

Maximum Magnitude Error value of the sign specified in a

Resolution	Unit
0.01	%

■ Application Example

"Reading out the maximum Magnitude Error value."

<Program>
DSPL MODANAL
SWP
PMAGTDERR?

<Response>
16.67

PMAGTDSYM

Symbol at Peak Magnitude Error

Program Message	Query Message	Response Message
—	PMAGTDSYM? a	b

■ Function

Outputs the symbol value obtained when Magnitude Error reaches the maximum instantaneous value on the Modulation Analysis screen.

■ Value a

Magnitude Error positive/negative sign

a	Positive/Negative sign
None	Peak value
+	Positive peak value
–	Negative peak value

■ Value b

Symbol value

Resolution	Unit
0.1	symbol

■ Application Example

"Reading out the symbol value obtained when Magnitude Error reaches the maximum value."

<Program>
MEAS MODANAL
PMAGTDSYM?

<Response>
13.1

POWER

Power

Program Message	Query Message	Response Message
—	POWER? a	b

■ Function

Outputs the absolute value or relative value of RF average power measured by the power meter.

■ Value a

Readout unit

a	Unit
DBM	dBm
WATT	W
DB	dB

■ Value b

Absolute value or relative value of RF average power

Unit	Resolution
0.01 (dBm, dB)	In accordance with the value a
0.001 (W)	

■ Application Example

"Reading out RF average power in dBm units."

<Program>
POWER? DBM

<Response>
–1.43

PPHASEERR

Peak Phase Error

Program Message	Query Message	Response Message
—	PPHASEERR? a	b

■ Function

Outputs the maximum instantaneous value of the phase error on the Modulation Analysis screen.

■ Value a

Phase error sign

a	Positive/Negative sign
None	Peak value
+	Positive peak value
–	Negative peak value

■ Value b

Maximum phase error value of the sign specified in a

Resolution	Unit
0.01	deg

■ Application Example

"Reading out the maximum absolute value of the phase error."

<Program>
MEAS MODANAL
PPHASEERR?

<Response>
7.21

PPHASESYM

Symbol at Peak Phase Error

Program Message	Query Message	Response Message
—	PPHASESYM? a	b

■ Function

Outputs the symbol value obtained when Phase Error reaches the maximum instantaneous value on the Modulation Analysis screen.

■ Value a

Phase Error positive/negative sign

a	Positive/Negative sign
None	Peak value
+	Positive peak value
−	Negative peak value

■ Value b

Symbol value

Resolution	Unit
0.1	symbol

■ Application Example

"Reading out the symbol value obtained when Phase Error reaches the maximum value."

<Program>
MEAS MODANAL
PPHASESYM?

<Response>
83.1

PRE

Preset

Program Message	Query Message	Response Message
PRE	—	—

■ Function

Initializes all the measurement control parameters that need to be initialized. This function has the same effect as the INI and IP commands.

■ Application Example

"Initializing the parameters that need to be initialized."

<Program>
PRE

PREAMP

Pre Ampl

Program Message	Query Message	Response Message
PREAMP a	PREAMP?	a

■ Function

Sets Pre Ampl on/off.

■ Value a

On/off setting of Pre Ampl

a	Pre Ampl	Initial value
ON	Sets Pre Ampl to on.	
OFF	Sets Pre Ampl to off.	*

■ Setting initialization

*RST

■ Application Example

"Setting Pre Ampl to on."

<Program>
PREAMP ON
PREAMP?

<Response>
ON

■ Note

* This function is optional.

PVECTERR

Peak EVM

Program Message	Query Message	Response Message
—	PVECTERR?	a

■ Function

Outputs the measured results of the peak EVM value on the Modulation Analysis screen.

■ Value a

Peak EVM

Resolution	Unit
0.01	%

■ Application Example

"Reading out the Peak EVM value."

<Program>
DSPL MODANAL
SWP
PVECTERR?

<Response>
45.23

PWRCAL

Power Calibration

Program Message	Query Message	Response Message
PWRCAL	PWRCAL?	a

■ Function

Performs calibration during the power measurement with "PWRCAL" and reads out the calibration value with "PWRCAL?". The calibration value can be set only by external control with "CALVAL."

■ Value a

Calibration value

Range	Resolution	Initial value	Unit
–10.00 to 10.00	0.01	0.00	dBm

■ Application Example

"Performing calibration during the power measurement."

<Program>
CALVAL 2.33
PWRCAL?
PWRCAL

<Response>
2.33

QLVL

Q Level (RMS)

Program Message	Query Message	Response Message
—	QLVL? a	b

■ Function

Reads out the measurement results of the RMS value for Signal Q on the IQ Level screen.

■ Value a

Readout unit

a	Readout unit
None	Existing setting unit
MV	mV
DBMV	dBmV

■ Value b

RMS value for Signal Q

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the RMS value for Level Q."

<Program>
MEAS IQLVL
QLVL? MV

<Response>
0.53

QPPLVL

Q Level (Peak to Peak)

Program Message	Query Message	Response Message
—	QPPLVL? a	b

■ Function

Reads out the measurement results of the Peak to Peak value for Signal Q on the IQ Level screen.

■ Value a

Readout unit

a	Readout unit
None	Existing setting unit
MV	mV
DBMV	dBmV

■ Value b

Peak to Peak value for Signal Q

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the Peak to Peak value for Level Q."

<Program>
MEAS IQLVL
QPPLVL? MV

<Response>
3.55

RATIO

On/Off Ratio

Program Message	Query Message	Response Message
—	RATIO?	a

■ Function

Outputs the ratio of average intra-burst power (Tx Power) to average power (Carrier Off Power) when transmission is set to off on the RF Power screen.

■ Value a

On/Off Ratio

Resolution	Unit
0.01	dB

■ Application Example

"Reading out the On/Off Ratio."

<Program>
DSPL RFPWR
SWP
RATIO?

<Response>
72.66

RFINPUT

RF Input connector

Program Message	Query Message	Response Message
RFINPUT a	RFINPUT?	a

■ Function

Sets the connector of the RF signal to be input.

■ Value a

RF signal level

a	RF signal level	Initial value
HIGH	High Power	*
LOW	Low Power	

■ Setting initialization

*RST

■ Application Example

"Setting the RF signal level to High Power."

<Program>
RFINPUT HIGH
RFINPUT?

<Response>
HIGH

RFLVL

Reference Level

Program Message	Query Message	Response Message
RFLVL a	RFLVL?	a

■ Function

Sets the Reference Level on the Setup Common Parameter screen.

■ Value a

Reference Level

Range	RF Input	Initial value	Resolution	Unit
–(10.00+Reference Level Offset) to (42.00+Reference Level Offset)	High Power	30.00	0.01	dBm
–(30.00+Reference Level Offset) to (22.00+Reference Level Offset)	Low Power	22.00	0.01	dBm

☐ Suffix code

None : dBm

DBM : dBm

■ Constraint

- No setting is allowed when the terminal is one other than RF.

■ Setting initialization

*RST

■ Application Example

"Setting the Reference Level to –10.00 dBm."

<Program>

TERM RF

RFINPUT HIGH

RFLVLOFS 0

RFLVL –10.00

RFLVL?

<Response>

–10.00

RFLVLOFS

Reference Level Offset

Program Message	Query Message	Response Message
RFLVLOFS a	RFLVLOFS?	a

■ Function

Sets the Offset value for the Reference Level on the Setup Common Parameter screen.

■ Value a

Reference Level Offset

Range	Resolution	Initial value	Unit
–99.99 to 99.99	0.01	0.00	dB

☐ Suffix code

None : dB

DB : dB

■ Constraint

- No setting is allowed when the terminal is one other than RF.

■ Setting initialization

*RST

■ Application Example

"Setting the Reference Offset Level to 0.00 dB."

<Program>

TERM RF

RFLVLOFS 0.00

RFLVLOFS?

<Response>

0.00

RNG

Range

Program Message	Query Message	Response Message
RNG a	—	—

■ Function

Increases and decreases the power meter measurement range.

■ Value a

a: Operation of the power meter range

a	Operation of the power meter range
UP	Increases the measurement range by one step.
DN	Decreases the measurement range by one step.

■ Application Example

<Program>
RNG UP

RNG1

Range1

Program Message	Query Message	Response Message
RNG1	—	—

■ Function

Sets the power meter measurement range to the lowest level.

When the Input RF level is set to High power, the lowest range value is 0 dBm. At Low power, it is -20 dBm.

■ Application Example

"Setting the power meter measurement range to the lowest level."

<Program>

RNG1

RNG2

Range2

Program Message	Query Message	Response Message
RNG2	—	—

■ Function

Sets the power meter measurement range to the second lowest level.
When the Input RF level is set to High power, the second lowest range value is 10 dBm. At Low power, it is -10 dBm.

■ Application Example

"Setting the power meter measurement range to the second lowest level."

<Program>
RNG2

RNG3

Range3

Program Message	Query Message	Response Message
RNG3	—	—

■ Function

Sets the power meter measurement range to the intermediate level.

When the Input RF level is set to High power, the intermediate range value is +20 dBm. At Low power, it is 0 dBm.

■ Application Example

"Setting the power meter measurement range to the intermediate level."

<Program>

RNG3

RNG4

Range4

Program Message	Query Message	Response Message
RNG4	—	—

■ Function

Sets the power meter measurement range to the fourth lowest level.

When the Input RF level is set to High power, the fourth lowest range is +30 dBm. At Low power, it is +10 dBm.

■ Application Example

"Setting the power meter measurement range to the fourth lowest level."

<Program>

RNG4

RNG5

Range5

Program Message	Query Message	Response Message
RNG5	—	—

■ Function

Sets the power meter measurement range to the highest level.

When the Input RF level is set to High power, the highest range value is +40 dBm. At Low power, it is +20 dBm.

■ Application Example

"Setting the power meter measurement range to the highest level."

<Program>

RNG5

SETREL

Set Relative level

Program Message	Query Message	Response Message
SETREL	—	—

■ Function

Sets the power value displayed on the Power Meter screen to the reference value for relative value display.

■ Application Example

"Setting the currently displayed power value to the reference value for relative value display."

<Program>
SETREL

SLCTTEMP

Select Template for RF Power

Program Message	Query Message	Response Message
SLCTTEMP a	SLCTTEMP?	a
—	SLCTTEMP?	NOT

■ Function

Initializes the currently displayed standard template on the RF Power screen. When a template other than the standard template is displayed because of changes made to the template settings, NOT is returned as a response. This function has the same effect as the SLCTTEMP_RFPWR command.

■ Value a

Template

a	Template	Initial value
STD	Initializes the currently displayed standard template.	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Bringing the value back to the standard template."

<Program>
DSPL SETTEMP_RFPWR
SLCTTEMP STD
SLCTTEMP_RFPWR?

<Response>
STD

SLCTTEMP_RFPWR

Recall Template for RF Power

Program Message	Query Message	Response Message
SLCTTEMP_RFPWR a	SLCTTEMP_RFPWR?	a
—	SLCTTEMP_RFPWR?	NOT

■ Function

Initializes the currently displayed standard template on the RF Power screen. When a template other than the standard template is displayed because of changes made to the template settings, NOT is returned as a response.

■ Value a

Template

a	Template	Initial value
STD	Initializes the currently displayed standard template.	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Bringing the value back to the standard template."

<Program>
DSPL SETTEMP_RFPWR
SLCTTEMP_RFPWR STD
SLCTTEMP_RFPWR?

<Response>
STD

SLOTPWR

Slot Power

Program Message	Query Message	Response Message
—	SLOTPWR? a	b

■ Function

Outputs average power for each slot in a single frame on the RF Power screen.

■ Value a

Slot No.

Range	Resolution
0 to 7	1

■ Value b

Average power of the specified slot

Resolution	Unit
0.01	dBm

■ Application Example

"Reading out average power for the 6th slot."

<Program>
DSPL RFPWR
SWP
SLOTPWR? 5

<Response>
7.21

SNGLS

Single Sweep

Program Message	Query Message	Response Message
SNGLS	—	—

■ Function

Executes sweep/measurement. Receives the next message even when the sweep/measurement is not yet completed.

■ Application Example

"Executing sweep/measurement."

<Program>
SNGLS

SPUFREQ

Spurious Frequency

Program Message	Query Message	Response Message
—	SPUFREQ? Fa, b	c(1), c(2), ..., c(b)

■ Function

Reads out the spurious frequency for each frequency table on the Spurious Emission screen.

■ Value a

Frequency table number from which to start readout

Range	Resolution
1 to 15	1

■ Value b

Number of readouts

Range	Number of readouts	Resolution
1 to 15	1 to 15	1

■ Value c

Spurious frequency

Resolution	Unit
1	Hz

■ Application Example

"Obtaining the spurious frequency from f1 to f3 in Spot Mode."

<Program>
DSPL SPURIOUS,SPOT
SWP
SPUFREQ? F1,3

<Response>
1775300000,1776200000,1776110000

SPUFREQLVL

Spurious Frequency and Level

Program Message	Query Message	Response Message
—	SPUFREQLVL? Fa, b, c	d(1), e(1), d(2), e(2), ..., d(b), e(b)

■ Function

Reads out the spurious frequency and spurious level for each frequency table on the Spurious Emission screen.

■ Value a

Frequency table number from which to start readout

Range	Resolution
1 to 15	1

■ Value b

Number of readouts

b	Number of readouts	Resolution
1 to 15	1 to 15	1

■ Value c

Output unit of the spurious level

c	Unit
None	Existing setting unit
DBM	dBm
DB	dB

■ Value d

Spurious frequency

Resolution	Unit
1	Hz

■ Value e

Spurious level

Resolution	Unit
0.01	Depends on the value c

■ Application Example

"Obtaining the spurious frequency and spurious level from f1 to f3 in dBm in Spot Mode."

<Program>

```
DSPL SPURIOUS,SPOT
SWP
SPUFREQLVL? F1,3,DBM
```

<Response>

1775300000, –56.23,1776200000, –42.94, 1776110000, –58.71

SPULVL

Spurious Level

Program Message	Query Message	Response Message
—	SPULVL? Fa, b, c	d(1), d(2), ..., d(b)

■ Function

Reads out the spurious level for the frequency table on the Spurious Emission screen.

■ Value a

Frequency table number from which to start readout

Range	Resolution
1 to 15	1 to 15

■ Value b

Number of readouts

b	Number of readouts	Resolution
1 to 15	1 to 15	1

■ Value c

Output unit

c	Unit
None	Existing setting unit
DBM	dBm
DB	dB

■ Value d

Spurious level

Resolution	Unit
0.01	Depends on the value c

■ Application Example

"Reading out the spurious level from f1 to f3 in dBm in Spot Mode."

<Program>
DSPL SPURIOUS,SPOT
SWP
SPULVL? F1, 3, DBM

<Response>
–56.23, –42.94, –58.71

STRG_ADJ

Storage Mode for Output RF Spectrum

Program Message	Query Message	Response Message
STRG_ADJ a	STRG_ADJ?	a

■ Function

Sets the display mode on the Output RF Spectrum screen.

■ Value a

Display mode

a	Display mode	Initial value
NRM	Normal: Performs Normal display (single measurement).	*
AVG	Average: Measures the number of times specified by Average Count, and then displays the average value of the results.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the average value."

<Program>
MEAS ADJ,HIGH
STRG_ADJ AVG
STRG_ADJ?

<Response>
AVG

STRG_IQL

Storage Mode for IQ Level

Program Message	Query Message	Response Message
STRG_IQL a	STRG_IQL?	a

■ Function

Sets the method for displaying the measurement results on the IQ Level screen.

■ Value a

Display method

a	Display mode	Initial value
NRM	Normal: Performs a single measurement and display the results.	*
AVG	Average: Measures the number of times specified by Average Count, and then displays the average value of the results.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the average value."

<Program>
DSPL IQLVL
STRG_IQL AVG
STRG_IQL?
SNGLS

<Response>
AVG

STRG_MOD

Storage Mode

Program Message	Query Message	Response Message
STRG_MOD a	STRG_MOD?	a

■ Function

Sets the display mode on the Modulation Analysis screen.

■ Value a

Display mode

a	Display mode	Initial value
NRM	Normal: Normal display (single measurement).	*
AVG	Average: Measures the number of times specified by Average Count, and then displays the average value of the results.	
OVER	Overwrite: Displays the plotted measurement results to be overwritten successively during continuous measurement.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the average value."

<Program>
MEAS MODANAL
STRG_MOD AVG
STRG_MOD?

<Response>
AVG

STRG_RFPWR

Storage Mode for RF Power

Program Message	Query Message	Response Message
STRG_RFPWR a	STRG_RFPWR?	a

■ Function

Sets the display mode on the RF Power screen.

■ Value a

Display mode

a	Display mode	Initial value
NRM	Normal: Normal display (single measurement).	*
AVG	Average: Measures the number of times specified by Average Count, and then displays the average value of the results.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Displaying the average value."

<Program>
MEAS RFPWR
STRG_RFPWR AVG
STRG_RFPWR?

<Response>
AVG

SWP

Single Sweep or Sweep Status

Program Message	Query Message	Response Message
SWP	SWP?	SWP a

■ Function

Executes sweep once. Switches the sweep mode to "SINGLE" and executes sweep when the SWP program command is received. Processing of the next command is suspended until the sweep is completed. The SWP? command is used to check on the current sweep state (whether sweep has been completed or is underway).

■ Value a

Sweep state

Resolution	Unit
a	Sweep state
0	Sweep completed
1	Sweep underway

■ Application Example

"Executing sweep once and checking sweep state."

<Program>
SWP
SWP?

<Response>
1

SWPWR

Switching Transients

Program Message	Query Message	Response Message
---	SWPWR? Fa, b, c	d

■ Function

Reads out the Switching Transients value on the Output RF Spectrum screen.

■ Value a

Frequency table

Range	Resolution
1 to 15	1

■ Value b

Lower/Upper

b	Lower/Upper
UP	Upper
LOW	Lower

■ Value c

Output unit

c	Output unit
DB	dB
DBM	dBm

■ Constraints

- When a, b or c is not set, the carrier frequency level is read out in dBm units.
- When only the value c is not set, readout takes place in the unit set by Unit for Output RF Spectrum.

■ Application Example

[1] "Reading out Switching Transients for the Carrier Frequency."

<Program>
DSPL ADJ,HIGH
SWP
SWPWR?

<Response>
–39.56

[2] "Reading out Switching Transients on the Upper side of Frequency Table f6 in dB."

<Program>
DSPL ADJ, HIGH
SWP
SWPWR? F6, UP, DB

<Response>
–42.99

SYMOFS

Symbol align offset

Program Message	Query Message	Response Message
SYMOFS a	SYMOFS?	a

■ Function

Either sets the symbol reference point to the standard or shifts it by 0.5 symbol on the Setup Common Parameter screen.

■ Value a

Symbol align offset

a	Symbol align offset	Initial value
NRM	Normal	*
HALF	Half	

■ Setting initialization

*RST

■ Application Example

"Setting the symbol align offset to Half."

<Program>
SYMOFS HALF
SYMOFS?

<Response>
HALF

TBLFREQ_SPU

Setup Center Frequency

Program Message	Query Message	Response Message
TBLFREQ_SPU a, Fb, c	TBLFREQ_SPU? a, Fb	c
TBLFREQ_SPU a, HRM		

■ Function

Sets the frequency for each frequency table on the Setup Spot Table and Setup Search/Sweep Table screens. When the second argument is set to HRM, a frequency which is n times (n = 2,3,4...,n) greater than the carrier frequency is set for the frequency for f1 to f15 within the setting range of the carrier frequency.

■ Value a

Setting item

a	Frequency Table	Setting item
SPOT	Spot	Frequency measured in Spot Mode
START	Sweep/Search	Frequency from which to start sweep in Sweep/Search Mode
STOP	Sweep/Search	Frequency at which to end sweep in Sweep/Search Mode

■ Value b

Frequency table No.

Range	Resolution	Frequency Table
1 to 15	1	Spot, Sweep/Search

■ Value c

Frequency

Range	Value a	Resolution	Unit
100 to 7800000000	SPOT	1	Hz
1000 to 7799999000 1000 to 13199999000	START	1	Hz
2000 to 7800000000 2000 to 13200000000	STOP	1	Hz
0	SPOT, START, STOP	---	---

- When 0 is set, the set value for the frequency table will be deleted.

☐ Suffix code

None : Hz

HZ : Hz

KHZ, KZ : kHz

MHZ, MZ : MHz

GHZ, GZ : GHz

■ Setting initialization

*RST

■ Application Example

"Setting the frequency for the Frequency Spot Table 4 to 1,850 MHz."

<Program>

DSPL SETTBL_SPU,SPOT

TBLFREQ_SPU SPOT,F4,1850MHZ

TBLFREQ_SPU? F4

<Response>

1850000000

TBLRBW_SPU

Setup RBW

Program Message	Query Message	Response Message
TBLRBW_SPU a,Fb,c	TBLRBW_SPU? a,Fb	c

■ Function

Sets RBW for each frequency table on the Setup Spot Table and Setup Search/Sweep Table screens.

■ Value a

Frequency Table

a	Frequency Table
SPOT	Spot
SWEEP	Sweep/Search

■ Value b

Frequency table No.

Range	Resolution
1 to 15	1

■ Value c

RBW

c	Unit
300	Hz
1000	
3000	
10000	
30000	
100000	
300000	
1000000	
3000000	
5000000	
10000000	
20000000	

☐ Suffix code

None : Hz

HZ : Hz

KHZ, KZ : kHz

MHZ, MZ : MHz

GHZ, GZ : GHz

■ Setting initialization

*RST

■ Application Example

"Setting RBW for the Frequency Spot Table 4 to 30 kHz."

<Program>

DSPL SETTBL_SPU,SPOT

TBLRBW_SPU SPOT,F4,30KHZ

TBLRBW_SPU? F4

<Response>

30000

TBLRBWMD_SPU

RBW Set Mode

Program Message	Query Message	Response Message
TBLRBWMD_SPU a,b	TBLRBWMD_SPU? a	b

■ Function

Sets the method to enter RBW on the Setup Spot Table and Setup Sweep/Search Table screens.

■ Value a

Selection of the Spot Table or Sweep/Search Table

a	Setup Table
SPOT	Spot Table
SWEEP	Sweep/Search Table

■ Value b

RBW Set Mode

a	RBW Set Mode	Initial value
AUTO	RBW is automatically set internally.	*
MAN	Any RBW can be set.	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the method to set RBW in the Setup Spot Table to Manual."

<Program>
DSPL SETTBL_SPU,SPOT
TBLRBWMD_SPU SPOT,MAN
TBLRBWMD_SPU? SPOT

<Response>
MAN

TEMPLVL_RFPWR

Level Modify for RF Power Template

Program Message	Query Message	Response Message
TEMPLVL_RFPWR a, b, c	TEMPLVL_RFPWR? a, b	c

■ Function

Customizes the currently displayed template on the Setup Template for RF Power screen.

■ Value a

Selection of the upper frame or lower frame of the template

a	Selection of the upper frame or lower frame of the template
UP	Upper: Changes the setting of the upper frame.
LOW	Lower: Changes the setting of the lower frame.

■ Value b

Template position

Range	Value a (Upper frame/Lower frame)	Template Type
1 to 5	Upper	NB at GMSK, AB, BTS1900 at GMSK
1	Lower	
1 to 6	Upper	NB at 8-PSK
1 to 3	Lower	

■ Value c

Power

Range	Resolution	Unit
-110.0 to 10.0	0.1	dB
		4 dBm (a=Upper b=1 only)

☐ Suffix code

None : dB

DB : dB

DBM : dBm

DB : dB

DBM : dBm

☐ Initial value (Standard)

Template Type	Value a (Upper frame/Lower frame)	Value b (Position)	Initial value of c (Standard)
NB at GMSK, AB	Upper	1	–59.0 dB
		2	–30.0 dB
		3	–6.0 dB
		4	4.0 dB
		5	1.0 dB
	Lower	1	–1.0 dB
NB at 8-PSK	Upper	1	–59.0 dB
		2	–30.0 dB
		3	–6.0 dB
		4	4.0 dB
		5	2.4 dB
		6	4.0 dB
	Lower	1	–2.0 dB
		2	0.0 dB
		3	–15.0 dB
BTS1900 at GMSK	Upper	1	–30.0 dB
		2	–30.0 dB
		3	0.0 dB
		4	4.0 dB
		5	1.0 dB
	Lower	1	–1.0 dB

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Changing the level of Upper 1 for the NB at 8-PSK template-type to –49.5 dB."

<Program>

DSPL SETTEMP_RFPWR

TEMPTYPE_RFPWR NB8PSK

TEMPLVL_RFPWR UP, 1, –49.5

TEMPLVL_RFPWR? UP, 1?

<Response>

–49.5

TEMPOFFLVL

Setup Off Level

Program Message	Query Message	Response Message
TEMPOFFLVL a	TEMPOFFLVL?	a

■ Function

Sets the unit of template Upper Level 1 (power when transmission is set to off) on the Setup Template for RF Power screen.

■ Value a

Unit of Upper Level 1 of the template

a	Unit of template Upper Level 1	Initial value
DBM	dBm	
DB	dB	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the unit of template Upper Level 1 to dB."

<Program>
DSPL SETTEMP_RFPWR
TEMPOFFLVL DB
TEMPOFFLVL?

<Response>
DB

TEMPPASS

Template Pass

Program Message	Query Message	Response Message
—	TEMPPASS? a	b

■ Function

Judges waveform passes and failures measured using a template on the RF Power screen. As for the criteria, if a waveform is found to have been contained within all points of a template, the waveform is judged passes (Pass). On the other hand, if a waveform is found to have gone beyond the template even at a single point, the waveform fails (FAIL).
This function has the same effect as the TEMPASS_RFPWR command.

■ Value a

Selection of Burst On interval/Off interval

a	Selection of Burst On interval/Off interval
ON	On interval
OFF	Off interval

■ Value b

Pass and failure judgment

b	Pass and failure judgment
PASS	Pass : Passed
FAIL	Fail : Not passed

■ Application Example

"Judging passes and failures of the measured RF Power waveform."

<Program>
DSPL RFPWR
WINDOW SLOT
TEMPTYPE_RFPWR NBGMSK
SWP
TEMPPASS? ON

<Response>
PASS

TEMPPASS_RFPWR

Template Pass

Program Message	Query Message	Response Message
—	TEMPPASS_RFPWR? a	b

■ Function

Judges waveform passes and failures measured using a template on the RF Power screen. As for the criteria, if a waveform is found to have been contained within all points of a template, the waveform is judged passes (Pass). On the other hand, if a waveform is found to have gone beyond the template even at a single point, the waveform fails (FAIL).
This function has the same effect as the TEMPPASS command.

■ Value a

Selection of Burst On interval/Off interval

a	Selection of Burst On interval/Off interval
ON	On interval
OFF	Off interval

■ Value b

Pass and failure judgment

b	Pass and failure judgment
PASS	Pass : Passed
FAIL	Fail : Not passed

■ Application Example

"Judging passes and failures of the measured RF Power waveform."

<Program>
DSPL RFPWR
WINDOW SLOT
TEMPTYPE_RFPWR NBGMSK
SWP
TEMPPASS_RFPWR? ON

<Response>
PASS

TEMPRPWR

Reference Power for Template

Program Message	Query Message	Response Message
—	TEMPRPWR?	a

■ Function

Outputs power (template level 1) specified by the template when transmission is off in the form of the relative value of the average intra-burst power on the RF Power screen.

■ Value a

Specified power when transmission is set to off

Resolution	Unit
0.1	dB

■ Application Example

"Outputting specified power when transmission is set to off."

<Program>
DSPL RFPWR
SWP
TEMPRPWR?

<Response>
–59.0

TEMPTYPE_RFPWR

Template Type for RF Power

Program Message	Query Message	Response Message
TEMPTYPE_RFPWR a	TEMPTYPE_RFPWR?	a

■ Function

Sets the frame for the standard template on the RF Power screen.

■ Value a

Template type

a	Template type	Initial value
NBGMSK	NB at GMSK	*
AB	AB	
NB8PSK	NB at 8PSK	
B19GMSK	BTS1900 at GMSK	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the template-type to NB at 8PSK."

<Program>
DSPL SETTEMP_RFPWR
TEMPTYPE_RFPWR? NB8PSK
TEMPTYPE_RFPWR?

<Response>
NB8PSK

TERM

Input terminal

Program Message	Query Message	Response Message
TERM a	TERM?	a

■ Function

Sets the connector for the input signal to be measured on the Setup Common Parameter screen.

■ Value a

Connector type

a	Connector	Initial value
RF	RF	*
IQDC	IQ-DC	
IQAC	IQ-AC	
IQBAL	IQ-Balance	

■ Setting initialization

*RST

■ Application Example

"Setting the input signal to IQ-DC."

<Program>
DSPL SETCOM
TERM IQDC
TERM?

<Response>
IQDC

TRFORM

Trace Format

Program Message	Query Message	Response Message
TRFORM a	TRFORM?	a

■ Function

Sets the format for waveform display on the Modulation Analysis screen.

■ Value a

Waveform format

a	Waveform format	Modulation system	Initial value
NON	None: Displays the results in the form of numeric value only, with no waveform display.	GMSK, 8-PSK	*
TRLIS	Trellis: Displays changes in phase with the passage of time.	GMSK	
CONSTEL	Constellation: Displays the IQ diagram.	GMSK, 8-PSK	
EVM	EVM: Displays the size of the vector error.	8-PSK	
EYE	Eye Diagram: Displays the changes in Signal IQ with the passage of time.	GMSK, 8-PSK	
PHASE	Phase Error: Displays the phase error.	GMSK, 8-PSK	
MAGTD	Magnitude: Displays the amplitude error.	GMSK, 8-PSK	

■ Setting initialization

PRE, INI, IP, –RST

■ Application Example

"Setting the format for waveform display to Phase Error."

<Program>
MEAS MODANAL
TRFORM PHASE
TRFORM?

<Response>
PHASE

TRG

Trigger

Program Message	Query Message	Response Message
TRG a	TRG?	a

■ Function

Selects whether to start measurement with internal timing or with an external trigger on the Setup Common Parameter screen.

■ Value a

Trigger setting

a	Trigger setting	Initial value
FREE	Free Run	*
EXT	External	

■ Setting initialization

*RST

■ Application Example

"When inputting a trigger from the outside."

<Program>
TRG EXT
TRG?

<Response>
EXT

TRGDLY

Trigger Delay

Program Message	Query Message	Response Message
TRGDLY a	TRGDLY?	a

■ Function

Sets the time difference from when a trigger is input to when timing is actually set on the Setup Common Parameter screen.

■ Value a

Trigger delay value

Range	Resolution	Initial value	Unit
−120.000 to 120.000	0.001	0.000	ms

□ Suffix code

None : ms
US : μs
MS : ms
S : s

■ Constraint

- No setting is allowed when Trigger is set to Free Run.

n Setting initialization
*RST

■ Application Example

"Setting the trigger delay value to 50.000 ms."

<Program>
TRG EXT
TRGDLY 50
TRGDLY?

<Response>
50

TRGEDGE

Trigger Edge

Program Message	Query Message	Response Message
TRGEDGE a	TRGEDGE?	a

■ Function

Sets either the leading or trailing edge as the standard trigger timing on the Setup Common Parameter screen.

■ Value a

Trigger standard

a	Trigger standard	Initial value
RISE	Sets the leading edge as the trigger standard.	*
FALL	Sets the trailing edge as the trigger standard.	

■ Constraint

- No setting is allowed when Trigger is set to Free Run or Wide IF Video.

■ Setting initialization

*RST

■ Application Example

"Setting the leading edge as the trigger standard."

<Program>
TRG EXT
TRGEDGE RISE
TRGEDGE?

<Response>
RISE

TXPWR

Transmitter Power

Program Message	Query Message	Response Message
—	TXPWR? a	b

■ Function

Outputs the average intra-burst power on the RF Power and Spurious Emission screens.

■ Value a

Output unit

a	Output unit
DBM	dBm
WATT	W

■ Value b

Average intra-burst power

Resolution	Unit
0.01	Depends on the value a.

■ Application Example

"Reading out the measurement results of Tx Power."

<Program>
DSPL SPURIOUS, SPOT
SWP
TXPWR? DBM

<Response>
25.03

UNIT_ADJ

Unit for Output RF Spectrum

Program Message	Query Message	Response Message
UNIT_ADJ a	UNIT_ADJ?	a

■ Function

Sets the unit of display/readout for the measurement results on the Output RF Spectrum screen.

■ Value a

Unit of display/readout

a	Unit of display/readout	Initial value
DBM	dBm	*
DB	dB	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the unit of Output RF Spectrum to dB."

<Program>
MEAS ADJ, HIGH
UNIT_ADJ DB
UNIT_ADJ?

<Response>
DB

UNIT_IQL

Unit for IQ Level

Program Message	Query Message	Response Message
UNIT_IQL a	UNIT_IQL?	a

■ Function

Sets the measured results unit for the IQ Level on the IQ Level screen.

■ Value a

Unit of the IQ Level

a	Unit of the IQ Level	Initial value
MV	mV	
DBMV	dBmV	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the IQ Level unit to mV."

<Program>
MEAS IQLVL
UNIT_IQL MV
UNIT_IQL?

<Response>
MV

UNIT_SPU

Unit for Spurious Emission

Program Message	Query Message	Response Message
UNIT_SPU a	UNIT_SPU?	a

■ Function

Sets the display unit on the Spectrum Emission screen.

■ Value a

Unit

a	Unit	Initial value
DBM	dBm	*
DB	dB	

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the display unit to dB."

<Program>
DSPL SPURIOUS,SPOT
UNIT_SPU DB
UNIT_SPU?

<Response>
DB

VECTERR

RMS EVM

Program Message	Query Message	Response Message
—	VECTERR?	a

■ Function

Outputs the RMS value measurement results for EVM on the Modulation Analysis screen.

■ Value a

RMS EVM

Resolution	Unit
0.01	%

■ Application Example

"Reading out the RMS EVM value."

<Program>
DSPL MODANAL
SWP
VECTERR?

<Response>
23.48

VSCALE

Vertical Scale for EVM, Phase Error and Magnitude Error

Program Message	Query Message	Response Message
VSCALE a	VSCALE?	a

■ Function

Outputs the upper limit value of the vertical scale on the coordinate displayed on the Modulation Analysis screen when the Trace Format is set to EVM, Phase Error or Magnitude Error.

■ Value a

Upper limit value of the vertical scale

a	Upper limit value of the vertical scale	Initial value
5	5 [deg] or [%]	*
10	10 [deg] or [%]	
20	20 [deg] or [%]	
50	50 [deg] or [%]	
100	100 [deg] or [%]	

■ Constraint

- No setting is allowed when the Trace Format is set to other than EVM, Phase Error or Magnitude Error.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the upper limit value of the vertical scale for Phase Error to 50 [deg]."

<Program>
MEAS MODANAL
TRFORM PHASE
VSCALE 50
VSCALE?

<Response>
50

WIDE_RFPWR

Wide Dynamic Range

Program Message	Query Message	Response Message
WIDE_RFPWR a	WIDE_RFPWR?	a

■ Function

Sets the Wide Dynamic Range on/off on the RF Power screen.

■ Value a

Switching on/off of the Wide Dynamic Range

a	Switching on/off of the Wide Dynamic Range	Initial value
ON	On : Enables the Wide Dynamic Range.	
OFF	Off : Disables the Wide Dynamic Range.	*

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Enabling the Wide Dynamic Range."

<Program>
MEAS RFPWR
WIDE_RFPWR ON
WIDE_RFPWR?

<Response>
ON

WINDOW

Wave Window

Program Message	Query Message	Response Message
WAVEFORM a	WAVEFORM?	a

■ Function

Sets the waveform window on the RF Power screen.

■ Value a

Type of waveform window

a	Type of waveform window	Modulation Type	Initial value
SLOT	Slot : Displays the waveform for a single slot.	GMSK, 8-PSK	*
ONPORT	On Portion : Displays the enlarged waveform of the burst-on section.	GMSK	
FRAME	Frame : Displays the waveform for a single frame (8 slots).	GMSK, 8-PSK	
LEAD	Leading : Displays the waveform for the leading section of the burst.	GMSK, 8-PSK	
TRAIL	Trailing : Displays the waveform for the trailing section of the burst.	GMSK, 8-PSK	

■ Constraint

- The waveform window cannot be set to On Portion when the modulation-type is set at 8-PSK.

■ Setting initialization

PRE, INI, IP, *RST

■ Application Example

"Setting the waveform window to On Portion."

<Program>
MEAS RFPWR
WINDOW ONPORT
WINDOW?

<Response>
ONPORT

XMC

Wave Data for I-Q Signal

Program Message	Query Message	Response Message
XMC a, b, c	XMC? d, e, f	g(1), g(2), ..., g(f)

■ Function

Reads out and processes the waveform data for Signal IQ on the Modulation Analysis screen.

■ Value a

Selection of IQ

a	Selection of IQ
0	Signal I
1	Signal Q

■ Value b

Data writing address

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 1410	NB, Continuous	8-PSK	1

<Relation between the marker position and data storage address>

*1: Addresses 0 to 1470 are assigned to the Eye Diagram Marker Positions 0.0 symbol to 147.0 symbol (resolution: 0.1 symbol). Since the resolution of the Constellation marker position is 1.0 symbol, addresses 0, 10 ... 1470 are assigned to marker positions 0.0 symbol, 1.0 symbol ... 147.0symbol.

*2: When the modulation-type is set to 8-PSK, addresses 0 to 1410 are assigned to the Eye Diagram Marker Positions 3.0 symbol to 144.0 symbol (resolution: 0.1 symbol). As the resolution of the Constellation marker position is 1.0 symbol, addresses 0, 10 ...1410 are assigned to marker positions, 3.0 symbol, 4.0 symbol ... 144.0symbol.

■ Value c

16-bit waveform data to be written

Range	Resolution
−32768 to 32767	1

- Setting is made by using an integer in the unit of 0.0001 with the ideal signal "1" set at 10000.

■ Value d

Selection of IQ

d	Selection of IQ
0	Signal I
1	Signal Q

■ Value e

Address from which to start data readout:

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 1410	NB, Continuous	8-PSK	1

<Relation between the marker position and data storage address>

*1: Addresses 0 to 1470 are assigned to the Eye Diagram Marker Positions 0.0 symbol to 147.0 symbol (resolution: 0.1 symbol). Since the resolution of the Constellation marker position is 1.0 symbol, addresses, 0, 10 ... 1470, are assigned to marker positions 0.0 symbol, 1.0 symbol ... 147.0symbol.

*2: When the modulation type is set to 8-PSK, addresses 0 to 1410 are assigned to the Eye Diagram Marker Positions 3.0 symbol to 144.0 symbol (resolution: 0.1 symbol). As the resolution of the Constellation marker position is 1.0 symbol, addresses 0, 10 ...1410 are assigned to marker positions 3.0 symbol, 4.0 symbol ... 144.0symbol.

■ Value f

Number of data readouts (meaning the number of data readouts in order from the address from which data readout is started.)

Range	Measuring Object	Modulation Type	Resolution
1 to 1471	NB, AB, SB	GMSK	1
1 to 1551	Continuous		
1 to 1411	NB, Continuous	8-PSK	1

■ Value g (n)

16-bit waveform data to be read out

Range	Resolution
–32768 to 32767	1

- Data are read out by using an integer in the unit of 0.0001 with the ideal signal "1" set at 10000.

■ Application Example

"Making five readouts of the waveform data for Signal IQ from memory address 0."

<Program>
DSPL MODANAL
SWP
XMC? 0,0,5

<Response>
0, –1, 0, –1, 0

XMD

Wave Data for RF Power

Program Message	Query Message	Response Message
XMD a, b	XMD? c, d	e(1), e(2), ..., e(d)

■ Function

Reads out and processes the waveform data on the waveform display on the RF Power screen.

■ Value a

Data writing address

Range	Resolution
0 to 13010	1

<Relation between the marker position and data storage address>

Data storage addresses 0 to 13010 are assigned when the marker position ranges from the minimum value of the horizontal scale –27.0 symbol, when the window is set to Slot, to the maximum value of the horizontal scale 1274.0 symbol, when the window is set to Frame (resolution: 0.1 symbol). (See the table below.)

Marker Position [symbol]	–27.0	–26.9	0.0	1274.0
Data storage address	0	1	270	13010

■ Value b

16-bit waveform data to be written

Range	Resolution
–32768 to 32767	1

- Setting is made by using an integer in the unit of 0.01 dBm with 1 dBm set at 100.

■ Value c

Address from which to start data readout:

Range	Resolution
0 to 13010	1

■ Value d

Number of data readouts

Range	Resolution
1 to 13011	1

■ Value, e (n)

16-bit waveform data to be read out

Range	Resolution
–32768 to 32767	1

- Data are read out by using an integer in the unit of 0.01 dBm with 1 dBm set at 100.

■ Application Example

"Making five readouts of the waveform data of RF Power from memory address 0."

<Program>
DSPL RFPWR
SWP
XMD? 0,5

<Response>
–1012, –1743, –1823, –1272, –1055

XMN

Wave Data for Magnitude Error

Program Message	Query Message	Response Message
XMN a, b	XMN? c, d	e(1), e(2), ..., e(d)

■ Function

Reads out and processes the waveform data for Magnitude Error on the Modulation Analysis screen.

■ Value a

Data writing address

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 141	NB, Continuous	8-PSK	

<Relation between the marker position and data storage address>

*1: When the modulation type is set to GMSK, addresses 0 to 1410 are assigned to marker positions 0.0 symbol to 147.0 symbol (resolution: 0.1).

*2: When the modulation type is set to 8-PSK, addresses 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0).

■ Value b

16-bit waveform data to be written

Range	Resolution
–32768 to 32767	1

- Setting is made by using an integer in the unit of 0.01% with 1% set at 100.

■ Value c

Address from which to start data readout:

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 141	NB, Continuous	8-PSK	

<Relation between the marker position and data storage address>

*1: When the modulation type is set to GMSK, addresses 0 to 1410 are assigned to marker positions 0.0 symbol to 147.0 symbol (resolution: 0.1).

*2: When the modulation type is set to 8-PSK, addresses 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0).

■ Value d

Number of data readouts (meaning the number of data readouts in order from the address from which data readout is started.)

Range	Measuring Object	Modulation Type	Resolution
1 to 1471	NB, AB, SB	GMSK	1
1 to 1551	Continuous		
1 to 142	NB, Continuous	8-PSK	

■ Value, e (n)

16-bit waveform data to be read out

Range	Resolution
–32768 to 32767	1

- Data are read out by using an integer in the unit of 0.01 % with 1 % set at 100.

Application Example

"Making five readouts of the waveform data for Magnitude Error from memory address 0."

<Program>

DSPL MODANAL

SWP

XMN? 0,5

<Response>

0, 1413, –1, –7415, –1

XMP

Wave Data for Phase Error

Program Message	Query Message	Response Message
XMP a, b	XMP? c, d	e(1), e(2), ..., e(d)

■ Function

Reads out and processes the waveform data for Phase Error on the Modulation Analysis screen.

■ Value a

Data writing address

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 141	NB, Continuous	8-PSK	

<Relation between the marker position and data storage address>

*1: When the modulation type is set to GMSK, addresses 0 to 1410 are assigned to marker positions 0.0 symbol to 147.0 symbol (resolution: 0.1).

*2: When the modulation type is set to 8-PSK, addresses, 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0).

■ Value b

16-bit waveform data to be written

Range	Resolution
–32768 to 32767	1

- Setting is made by using an integer in the unit of 0.01 deg with 1 deg set at 100.

■ Value c

Address from which to start data readout:

Range	Measuring Object	Modulation Type	Resolution
0 to 1470	NB, AB, SB	GMSK	1
0 to 1550	Continuous		
0 to 141	NB, Continuous	8-PSK	

<Relation between the marker position and data storage address>

*1: When the modulation type is set to GMSK, addresses 0 to 1410 are assigned to marker positions 0.0 symbol to 147.0 symbol (resolution: 0.1).

*2: When the modulation type is set to 8-PSK, addresses 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0).

■ Value d

Number of data readouts (meaning the number of data readouts in order from the address from which data readout is started)

Range	Measuring Object	Modulation Type	Resolution
1 to 1471	NB, AB, SB	GMSK	1
1 to 1551	Continuous		
1 to 142	NB, Continuous	8-PSK	

■ Value e (n)

16-bit waveform data to be read out

Range	Resolution
–32768 to 32767	1

- Data are read out by using an integer in the unit of 0.01 deg with 1 deg set at 100.

■ Application Example

"Making five readouts of the waveform data for Phase Error from memory address 0."

<Program>

```
DSPL MODANAL
SWP
XMP? 0,5
```

<Response>

```
–1, –1660, 0, 8679, 0
```

XMV

Wave Data for EVM

Program Message	Query Message	Response Message
XMV a, b	XMV? c, d	e(1), e(2), ..., e(d)

■ Function

Reads out and processes the waveform data for EVM on the Modulation Analysis screen.

■ Value a

Data writing address

Range	Resolution
0 to 141	1

<Relation between the marker position and data storage address>

Addresses 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0 symbol).

■ Value b

16-bit waveform data to be written

Range	Resolution
–32768 to 32767	1

- Setting is made by using an integer in the unit of 0.01% with 1% set at 100.

■ Value c

Address from which to start data readout:

Range	Resolution
0 to 141	1

<Relation between the marker position and data storage address>

Addresses 0 to 141 are assigned to marker positions 3.0 symbol to 144.0 symbol (resolution: 1.0 symbol).

■ Value d

Number of data readouts (meaning the number of data readouts in order from the address from which data readout is started)

Range	Resolution
1 to 142	1

■ Value e (n)

16-bit waveform data to be read out

Range	Resolution
–32768 to 32767	1

- Data are read out by using an integer in the unit of 0.01% with 1% set at 100.

■ Application Example

"Making five readouts of the waveform data for EVM from memory address 0."

<Program>
DSPL MODANAL
SWP
XMV? 0, 5

<Response>
0, 3743, 0, 9272, 0

ZAJ

Zero Set

Program Message	Query Message	Response Message
ZAJ	—	—

■ Function

Executes zero-point calibration of the power meter. This function has the same effect as the ZEROSET command.

■ Application Example

<Program>
ZAJ

ZEROSET

Zero Set

Program Message	Query Message	Response Message
ZEROSET	—	—

■ Function

Executes zero-point calibration of the power meter. This function has the same effect as the ZAJ command.

■ Application Example

<Program>
ZEROSET

Anritsu Service and Sales offices

America

• Argentina
MULTIRADIO S.A.
Av. Cordoba, 4860 Buenos Aires,
C1414BAT, Argentina
TEL: +55-4779-5522
FAX: +55-4779-5510

• Brazil
ANRITSU ELETRÔNICA LTDA.
Praia de Botafogo 440, Sala 2401-Bota
CEP 22250-040, Rio de Janeiro, RJ, Brazil
TEL: +55-21-5276922
FAX: +55-21-537-1456

ANRITSU ELETRÔNICA LTDA.
(SÃO PAULO BRANCH OFFICE)
Praça Amadeu Amaral 27,Primera Andar,
Conj. 11, 12, 13, 14, Liberdade, São
Paulo, SP, Brazil CEP 01327-010
TEL: +55-11-283-2511
FAX: +55-11-288-6940

• Canada
ANRITSU ELECTRONICS LIMITED
(OTTAWA OFFICE)
102-215 Stafford Road West,
Nepean, Ontario K2H 9C1, Canada
TEL: +1-613-828-4090
FAX: +1-613-828-5400

ANRITSU ELECTRONICS LIMITED
(TORONTO OFFICE)
4-6810 Kitimat Road, Mississauga, Ontario
L5N 5M2, Canada
TEL: +1-905-286-1207
FAX: +1-905-286-1215

ANRITSU ELECTRONICS LIMITED.
(MONTREAL OFFICE)
200-1405 Trans-Canada Highway, Dorval,
Quebec, H9P 2V9, Canada
TEL: +1-514-421-3737
FAX: +1-514-685-9839

ANRITSU ELECTRONICS LIMITED
(CALGARY OFFICE)
Deerfoot Atrium, 6715-8th Street N.E.,
Ste 129 Calgary, Alberta T2E 7H7,
Canada
TEL: +1-403-275-9855
FAX: +1-403-275-3609

• Chile
SISTEMAS DE INSTRUMENTACION
LTDA.
Concha y Toro 65, Stgo Centro
Santiago, Chile 51880
TEL: +56-2-6960031
FAX: +56-2-6969665

• Colombia
RENTAMETRIC LTDA.
Calle 24 No. 32-67, Apartado: 23030
Santafe de Bogota, D.C. Colombia
TEL: +57-1-269-6555
FAX: +57-1-269-0191

• Costa Rica
ELECTRONIC ENGINEERING S.A.
200 metios norte Mall San Pedro, P.O.
Box 10146-1000 San Jose, Costa Rica
TEL: +506-283-3033
FAX: +506-225-1286

SONIVISION, S.A.
P.O. Box 620-1000, San Jose, Costa Rica
TEL: +506-231-5685
FAX: +506-231-6531

• Ecuador
EQUITRONICS S.A.
Belgica N-32 Hy Av. De Los Shyris,
Edificio IVSEMON PARK, Suite 4B, Quito,
Ecuador
TEL: +593-2-255-396
FAX: +593-2-255-396

• El Salvador
EMPRESA DE COMERCIO EXTERIOR
S.A. DE C.V.
Centro Comercial Feria Rosa, Alameda
Dr. Manuel Enrique Araujo, Edificio H,
Local 315 San Salvador, El Salvador
TEL: +503-243-3924
FAX: +503-243-3925

• Guatemala
IMPELSA.
17 Calle 31-86 Zona 7, Villa Linda II,
Apartado Postal 482-1 Guatemala,
Guatemala
TEL: +502-594-9977
FAX: +502-594-9468

• Mexico
SIHIKATRONICS mmWAVE S.A. DE
C.V.
Luz Savion 9-602 Col. Del Dalle Mexico
D.F. 03100, Mexico
TEL: +52-5-5437313
FAX: +52-5-5437317

• Panama
SUMINISTROS INDUSTRIALES, S.A.
P.O. Box 2789 Balboa, Republic of
Panama
TEL: +507-270-2328
FAX: +507-270-2329

• Paraguay
DATALAB S.R.L.
Avda. Artigas No 1645 Edificio "DataLab"
Asuncion, Paraguay
TEL: +595-21-20-9126
FAX: +595-21-20-9127

• Peru
SAKATA INGENIEROS S.A.
AV Canaval Moreyra 748, San Isidro,
Lima 27, Peru
TEL: +51-1-224-2514
FAX: +51-1-224-8148

• U.S.A.
ANRITSU COMPANY
NORTH AMERICAN REGION
OPERATIONS HEADQUARTERS,
SALES AND SERVICE
1155 East Collins Blvd., Richardson,
TX 75081, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-972-644-1777
FAX: +1-972-671-1877

ANRITSU COMPANY
CORPORATE OFFICES
490 Jarvis Drive, Morgan Hill,
CA 95037-2809, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-408-778-2000
FAX: +1-408-776-1744

ANRITSU COMPANY
SALES AND SERVICE, NJ OFFICE
10 New Maple Avenue, Unit 305,
P. O. Box 836,
Pine Brook, NJ 07058-0836, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-973-227-8999
FAX: +1-973-575-0092

ANRITSU COMPANY
SALES AND SERVICE, FL OFFICE
312 W. First Street, Suite 300, Sanford,
FL 32771, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-407-321-5130
FAX: +1-407-330-2018

ANRITSU COMPANY
SALES AND SERVICE, GA OFFICE
4625 Alexander Drive, Alpharetta,
GA 30022, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-678-566-0454
FAX: +1-678-566-1776

• Uruguay
CABONORTE S.A.
Colonia 1900, Esc. 603, Montevideo,
Uruguay
TEL: +598-2-430522
FAX: +598-2-418594

• Venezuela
RADIOCOMUNICACIONES CRUZ, C.A.
Calle La Colina Quinta. Elison, Frente al
teatro Alberto Mateo Caracas 1050,
Venezuela
TEL: +58-2-793-2322
FAX: +58-2-793-3429

Europe

• Austria
WIEN-SCHALL GmbH
Krichbaumgasse 25, A-1120 Vienna, Austria
TEL: +43-1-81155140
FAX: +43-1-81155180

• Belgium
ANRITSU GmbH
Grafenberger Allee 54-56, 40237 Düsseldorf, Germany
Local phone: 0800-90001 (toll free)
TEL: +49-211-96855-0
FAX: +49-211-96855-55

• Bulgaria
ELSINCO Representation OFFICE Sofia
h.e. Strelbishte, str. Kotlenski Prohod, bl. 96/6/14, BG-1408 Sofia, Bulgaria
TEL: +359-2-958-1245
FAX: +359-2-958-1698

• Croatia
ELSINCO REPRESENTATION OFFICE ZAGREB
Korculanska 3A, HR-10000 Zagreb, Croatia
TEL: +385-1-618-1448
FAX: +385-1-618-1449

• Czech Republic
ELSINCO PRAHA SPOL S.R.O.
Novodvorská 994, CZ-142 21 Praha, 4-Branik, Czech Republic
TEL: +420-2-4149-0147
FAX: +420-2-4447-2169

ELSINCO PRAHA SPOL S.R.O. (BRNO BRANCH OFFICE)
Strmá 19, CZ-616 00 Brno, Czech Republic
TEL: +420-5-4142-7211
FAX: +420-5-4142-7219

• Denmark
ANRITSU AB (DENMARK BRANCH OFFICE)
Tonsbakken 10, DK 2740, Skovlunde, Denmark
TEL: +45-44502160
FAX: +45-44502170

• Finland
ANRITSU AB (FINLAND BRANCH OFFICE)
Piispanportti 9, FIN-02240 Espoo, Finland
TEL: +358-9-435-522-0
FAX: +358-9-435-522-50

• France
ANRITSU S.A.
9, Avenue du Québec Z.A. de Courtabœuf, 91951 Les Ulis Cedex, France
TEL: +33-1-60-92-15-50
FAX: +33-1-64-46-10-65

ANRITSU S.A. (TOULOUSE OFFICE)
Bureau de Toulouse Région Centre Sud Ouest, France
TEL: +33-5-62070484
FAX: +33-5-62070668

ANRITSU S.A. (TOULON OFFICE)
Bureau de Toulon Région Centre Sud Est, France
TEL: +33-4-94040264
FAX: +33-4-94040265

ANRITSU S.A. (RENNES OFFICE)
Bureau de Rennes Région Ouest, France
TEL: +33-2-99521214
FAX: +33-2-99521224

• Germany
ANRITSU GmbH
Grafenberger Allee 54-56, 40237 Düsseldorf, Germany
TEL: +49-211-96855-0
FAX: +49-211-96855-55

ANRITSU GmbH (SALES CENTER SOUTH)
An der Steinernen Brücke 1, 85757 Karlsfield, Germany
TEL: +49-8131-3825-0
FAX: +49-8131-3825-95

• Greece
KOSTAS KARAYANNIS SA
58 Kapodistriou str, GR-142 35 Nea Ionia, Athens, Greece
TEL: +30-1-680-0460-4
FAX: +30-1-685-3522

• Hungary
ELSINCO BUDAPEST KFT
Pannónia utca 8. IV/I., H-1136 Budapest, Hungary
TEL: +36-1-339-0000
FAX: +36-1-339-4444

• Ireland
PEMA LTD.
Dromiskin, Dundalk, Co. Louth, Ireland
TEL: +353-42-72899
FAX: +353-42-72376

• Italy
ANRITSU S.p.A.
Via Elio Vittorini, 129, 00144 Roma EUR, Italy
TEL: +39-06-509 9711
FAX: +39-06-502-24-25

ANRITSU S.p.A. (Milano OFFICE)
C.D. Colleoni, Via Paracelso, 4 20041 AGRATE B.ZA (MI), Italy
TEL: +39-039-605-7021
FAX: +39-039-605-63-96

• Netherlands
C.N.ROOD BV
Blauwroodlaan 280 2718 SK Zoetermeer, The Netherlands
TEL: +31-79-360 00 18
FAX: +31-79-362-81-90

• Norway
ANRITSU AB (NORWAY BRANCH OFFICE)
Leangbukta 40 1370 Asker, Norway
MAIL: Postboks 188, 1371 Asker, Norway
TEL: +47-66-901190
FAX: +47-66-901212

• Poland
ELSINCO POLSKA SP. Z.O.O
ul Gdanska 50, 01-691 Warszawa, Poland
TEL: +48-22-39-832-4042 (Sat Link)
FAX: +48-22-832-2238

• Slovakia
ELSINCO SLOVENSKO S.R.O
Kudlákova 4, SK-844 15 Bratislava, Slovakia
TEL: +421 7 6428 41 65
FAX: +421 7 6428 44 54

ELSINCO SLOVENSKO S.R.O (KOŠiCE BRANCH OFFICE)
Floriánska 16, SK-043 13 Kosice, Slovakia
TEL: +421 95 62 26 729
FAX: +421 95 62 26 729
CONTACT: Mr. Igor Domorak, Branch Office Manager

• Slovenia
ELSINCO D.O.O.
Dalmatinova 2, SI-1000 Ljublijana, Slovenia
TEL: +386-61-133-62-77
FAX: +386-61-317-397

• Spain
ANRITSU ELECTRÓNICA, S.A.
Europa Empresarial Edificio Londres. Planta 1. Oficina 6 C/ Playa de Liencres, 2 28230 Las Rozas. Madrid, Spain
TEL: +34-91-6404460
FAX: +34-90-6404461

• Sweden
ANRITSU AB
Botvid Center, Fittja Backe 1-3 145 84, Stockholm, Sweden
TEL: +46-8-534-70700
FAX: +46-8-534-70730

• Switzerland

GIGACOMP AG
Gewerbezone Laetti CH-3053
Muenchenbuchsee, Switzerland
TEL: +41-31-868-44-55
FAX: +41-31-868-44-50

• United Kingdom

ANRITSU LTD.
200 Capability Green, Luton, Bedfordshire, LU1 3LU, United Kingdom
TEL: +44-1582-433200
FAX: +44-1582-731303

ANRITSU LTD.
(MANCHESTER OFFICE)
Landmark House, Station Road, Cheadle Hulme, Cheshire SK8 7BS, United Kingdom
TEL: +44-161-488-4990
FAX: +44-161-486-9064

ANRITSU LTD.
(BRISTOL OFFICE)
1230 Aztec West, Almondsbury, Bristol BS12 4SG, United Kingdom
TEL: +44-1454-615252
FAX: +44-1454-618017

ANRITSU LTD.
(LIVINGSTON OFFICE)
Unit 1, Knightsridge Industrial Estate, Turnbull Way, Knightsridge, Livingston EH54 8RB, United Kingdom
TEL: +44-1506-436111
FAX: +44-1506-436112

ANRITSU LTD.
(HERTS OFFICE)
Rutherford Close, Stevenage, Herts SG1 2EF, United Kingdom
TEL: +44-1438-740011
FAX: +44-1438-740202

Asia, Pacific and Africa

• Australia

ANRITSU PTY LTD.
Unit 3/170 Forster Road, Mount. Waverley, Vic., 3149, Australia
TEL: +61-3-9558-8177
FAX: +61-3-9558-8255

ANRITSU PTY. LTD.
(SYDNEY BRANCH OFFICE)
Suite 21/1A Ashley Lane,
Westmead NSW 2145, Australia
TEL: +61-2-9635-0800
FAX: +61-2-9635-0899

• Bahrain

BASMATECH
P. O. Box 5701, Manama, Bahrain
TEL: +973-273729
FAX: +973-725404

• China

ANRITSU COMPANY LTD.
(HONG KONG OFFICE)
Suite 719, 7/F, Chinachem Golden Plaza, 77 Mody Road, Tsimshatsui East, Kowloon, P.R. China
TEL: +852-2301-4980
FAX: +852-2301-3545

ANRITSU COMPANY LTD.
(BEIJING OFFICE)
Room No. 1515, Beijing Fourtune Building, 5 Dong-San-Huan-Bei-lu, Chao-Yang District, Beijing 100004, P.R. China
TEL: +86-10-6590-9230 to 9234
FAX: +86-10-6590-9235

ANRITSU COMPANY LTD.
(SHANGHAI OFFICE)
No. 511, Shanghai Jing Tai Building, No. 58 Mao Ming Non Road, Shanghai, P.R. China
TEL: +86-21-6415-5137 to 5138
FAX: +86-21-6472-6677

ANRITSU COMPANY LTD.
(GUANGZHOU OFFICE)
Room 3008-9, 7/F 30/F., Dongshan Plaza, 69 XianLie Zhong Road, Central, Guangzhou 510095, P.R. China
TEL: +86-20-8732-2231
FAX: +86-20-8732-2230

ANRITSU COMPANY LTD.
(CHENGDU OFFICE)
Block E, 26/F., New Times Square (Xin Shi Guang Chang), No. 42, Wen Wu Lu, XinHua Street Chengdu, 610017, P.R. China
TEL: +86-28-651-0011, 0022, 0033
FAX: +86-28-651-0055

ANRITSU COMPANY LTD.
(XI'AN OFFICE)
No. 2104, Hua Yuan Building Gao Xin Road II, High-Technic Development Zone, Xi'an 710075, P.R. China
TEL: +86-29-8484465, 8479813, 8472712
FAX: +86-29-8484455

ANRITSU COMPANY LTD.
(SHENZHEN OFFICE)
Room 1505, Building A, World Trade Plaza,
Fuhong Rd., Shenzhen 518033, P.R. China
TEL: +86-755-366-2848, 2847
FAX: +86-755-366-2849

ANRITSU COMPANY LTD.
(CHONGQING OFFICE)
Unit 9, 3F, Chongqing Marriott Hotel Office Tower, Chongqing 400010, P.R. China
TEL: +86-23-6383-0218, 0228
FAX: +86-6383-0238

Anritsu Electronics (Shanghai) CO.,LTD. (SERVICE OFFICE)
2F, Room B, 52 Section Factory Building No.516 Fu Te Road (N)
Waigaoquiao Free Trade Zone
Pudong, Shanghai 200131, P.R. China
TEL: +86-21-5868-0688

ANRITSU COMPANY LTD.
(SHENYANG OFFICE)
Room 2-185, City Plaza Shenyang
206 Nanjing North Street, Heping District
Shenyang 110001 P.R. China
TEL: +86-24-23341178 / +86-24 23341799
FAX: +86-24-23342838

ANRITSU COMPANY LTD.
(WUHAN OFFICE)
ZhongNan Plaza A1803
No.9 ZhongNan Road, WuChang District
WuHan HuBei 430072 P.R. China
TEL: +86-2787713355
FAX: +86-2787713366

• Cyprus

CHRIS RADIOVISION LTD.
23 Crete Street, T.T. 1061
P. O. Box 21989, 1515Nicosia, Cyprus
TEL: +357-2-766121
FAX: +357-2-765177

• Egypt

GIZA SYSTEMS ENGINEERING S.A.E
17 Teeba Street Mohandeseen P.O. Box 317 Dokki-Cairo 12311, Egypt
TEL: +20-2-3368095
FAX: +20-2-3385799

• Indonesia

PT. SUBUR SAKTI PUTERA
Graha Astri Aniela Angun, Jl. Tanah Abang III/15, Jakarta 10160, Indonesia
TEL: +62-21-352-4828
FAX: +62-21-352-4831

• Israel

TECH-CENT LTD.
P. O. Box 43259 (Mailing Address), Tel-Aviv 61430 Israel, Street Address: Raul Valenberg 4 Ramat Haahayal, Tel-Aviv 69710, Israel
TEL: +972-36-478563
FAX: +972-36-478334

• Korea

ANRITSU CORPORATION LTD.
(SEOUL OFFICE)
14F Hyun Juk Bldg. 832-41, Yeoksam-dong, Kangnam-ku, Seoul, 135-080, Korea
TEL: +82-2-553-6603
FAX: +82-2-553-6604 to 6605

ANRITSU CORPORATION LTD.
(DAEJEON OFFICE)
Room1503, Dong-a Officetel 538-8, Bangmyung-Dong, Yusong-gu, Taejeon, 305-301, Korea
TEL: +82-2-828-7783
FAX: +82-2-828-7785

ANRITSU CORPORATION LTD.
(SERVICE CENTER)
8F Samwon-Bldg, 1329-8, Seocho-Dong, Seocho-Ku, Seoul, 137-070, Korea
TEL: +82-2-581-6603
FAX: +82-2-582-6603

• **Kuwait**
TAREQ COMPANY
P.O. Box 20506 Safat, 13066 Safat, Kuwait
TEL: +965-431-0615
FAX: +965-431-4085

• **Malaysia**
O'CONNOR'S ENGINEERING SDN BHD
3rd Floor Bangnan O'Connor, 13 Jalan 223, 46100 Petaling Jaya, Selangor Darul Ehsan, Malaysia
TEL: +60-3-753-8400
FAX: +60-30-757-7871

• **Morroco**
SEDEL
24, 26, Bd, Resistance, Casablanca, Morroco
TEL: +212-2-302444
FAX: +212-2-449311

• **Nepal**
BR INTERNATIONAL PVT. LTD.
P. O. Box 60, Tamrakar Comm. Bldg., Bhotebahal Kathmandu, Nepal
TEL: +977-1-224-706
FAX: +977-1-227-956

• **New Zealand**
NILSEN TECHNOLOGIES (AUCKLAND OFFICE)
P. O. Box 9613, New market Unit 4, Ambury Court, 1 Porters Ave, Eden Terrace Auckland, New Zealand
TEL: +64-9-309-2464
FAX: +64-9-309-2968

NILSEN TECHNOLOGIES (WELLINGTON OFFICE)
35 Ulric Street, Plimmerton Wellington, New Zealand
TEL: +64-4-233-9116
FAX: +64-4-233-8366

• **Oman**
NATIONAL PROJECTS AND TECHNOLOGY COMPANY L.L.C
P. O. Box 97, Wadi Al Kabir, Postal Code 117, Sultanate of Oman
TEL: +968-793741
FAX: +968-796158

• **Pakistan**
AETCO
Zia Chambers, 25-Mcleod road, Lahore 54000, Pakistan
TEL: +92-42-7221716, 7311035
FAX: +92-42-7221456

SUPERIOR ELECTRONICS ASSOCIATED
B-98 Block H, North Nasimabad, Karachi-33, Pakistan
TEL: +92-21-613655

• **Philippines**
SALRITSU INTERNATIONAL TRADING CORPORATION
5QB ODC International Plaza Condominium, 219 Salcedo St., Legaspi Village, Makati City 1229, Philippines
TEL: +632-816-2646, 893-8998
FAX: +632-815-0986

• **Qatar**
QATAR COMMUNICATIONS LTD.
P. O. Box 2481, Doha Qatar
TEL: +974-4-424347
FAX: +974-4-324777

• **Saudi Arabia**
A. RAJAB & A. SILSILAH & CO.
P. O. Box 203, Jeddah 21411, Saudi Arabia
TEL: +966-2-6610006
FAX: +966-2-6610558

ELECTRONIC EQUIPMENT MARKETING CO.
P. O. Box 3750, Riyadh, 11481, Saudi Arabia
TEL: +966-3-887-0218
FAX: +966-3-887-0268

• **Singapore**
ANRITSU PTE. LTD.
10, Hoe Chiang Road #07-01/02, Keppel Towers, Singapore 089315
TEL: +65-6282-2400
FAX: +65-6282-2533

• **South Africa**
ETECSA (PTY) LTD.
12 Surrey Square Office Park, 330 Surrey Avenue, Ferndale, 2194 Randburg, South Africa (P. O. Box 4231 Randburg, 2125 South Africa)
TEL: +27-11-787-7200
FAX: +27-11-787-0446

• **Sri Lanka**
INFOTECHS LIMITED
441, Alwitigala Mawatha, Colombo, Sri Lanka
TEL: +94-1-598237
FAX: +94-1-598112

• **Taiwan**
ANRITSU COMPANY, INC. (TAIPEI OFFICE)
6F, 96, Sec. 3, Chien Kou North Road, Taipei, Taiwan
TEL: +886-2-2515-6050
FAX: +886-2-2509-5519

ANRITSU COMPANY, INC. (HSINCHU OFFICE)
11F-3, 270, Sec. 1, Kuang-Fu Rd., Hsinchu, Taiwan R.O.C.
TEL: +886-3-563-6601, 6602, 6603
FAX: +886-3-564-5819

• **Thailand**
JASMINE TELECOM SYSTEMS CO., LTD.
200 Moo 4, 9th Floor, Chaengwatana Road, Tambon Pakkret, Amphoe Pakkret, Nonthaburi 11120, Thailand
TEL: +66-2-502-3240, 3000
FAX: +66-2-962-2521

• **Turkey**
INTER INTRADE BILGISAYAR ELEKTRONIK SAN. TIC. A.S.
Egitim Mah. Poyraz Sok., Sadikoglu Is Merkezi 1, No: 11, Kadikoy Istanbul, Turkey
TEL: +90-216-4144758
FAX: +90-216-4144762

TEST
Sehit Adem Yavuz Sokak No. 14/15 06640, Kizilay-Ankara, Turkey
TEL: +90-312-419-3688
FAX: +90-312-419-4099

• **United Arab Emirates**
UTMOST ELECTRONICS TRADING L.L.C. (ABU DHABI BRANCH)
P. O. Box: 41175, Abu Dhabi, United Arab Emirates
TEL: +971-2-6458909
FAX: +971-2-6458907

• **Vietnam**
SYSTEM & TECHNOLOGIES VETNAM LTD.
Unit # B236, Binh Minh Hotel 27 Ly Thai To Str Hanoi, Vietnam
TEL: +84-48.264.728
FAX: +84-49.344.111

• **Zimbabwe**
MARTWELL ELECTRONICS (PVT) LTD.
P.O. Box CH 857 Chisipite Harare, Zimbabwe
TEL: +263-4-494928
FAX: +263-4-494927

Japan

• **Japan**
ANRITSU CORPORATION
5-10-27 Minami-azabu, Minato-ku, Tokyo 106-8570, Japan
TEL: +81-3-3446-1111
FAX: +81-3-3442-0235

Anritsu

ANRITSU CORPORATION
5-10-27, Minamiazabu, Minato-ku, Tokyo, 106-8570 Japan
PHONE. 03-3446-1111
TELEX J 34372 ANRITU

MP MASTER
MA34524